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A More Developed Sign

Advancing the Work of Jesper Hoffmeyer

Edited by

Donald Favareau

Paul Cobley

Kalevi Kull

Tartu 2012



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INTRODUCTION

DONALD FAVAREAU

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A sign addresses somebody, that is, creates in the mind of that person an equivalent sign, or perhaps a more developed sign. That sign which it creates I call the interpretant of the first sign. The sign stands for something, its object. It stands for that object, not in all respects, but in reference to a sort of idea, which I have sometimes called the ground of the representamen.¹

Charles Sanders Peirce (1839–1914)

And this is just what an interpretative process involves: fitting the sign into a wider set of circumstances, a context.²

Jesper Hoffmeyer (b. 1942)

For over forty years, Jesper Hoffmeyer has been addressing the world, fitting the signs of life, science, philosophy, mind and feeling into each other's wider sets of circumstances, and developing these signs in profound new ways and provocative contexts – and creating in the minds of his readers the grounds upon which to create their own equivalent signs, or perhaps more developed ones.

So when the idea of creating this volume was birthed by Kalevi Kull and myself, outside of a French café in Copenhagen on a brisk September day in 2011, it was clear that the most appropriate tribute we could pay to Jesper on the occasion of his 70th birthday would be to compile a scholarly compendium of his most generative signs – and of the interpretants, or consequently developed signs, that they have inspired in a host of provocative thinkers across the world.

¹ CP 2.228.

² Hoffmeyer 1996: 21; 146.

Thus, while the 1000 word limitation that we have placed on each of the following contributions was a decision made, at least in part, in order to be able to complete such a volume in so short a time, the strategy is also a deliberate way of playing with new formats, in order to produce new kinds of intellectual experiences in the reader – just as Jesper’s words have been doing so delightfully for scholars and for laypeople over the course of the last four decades.

Indeed, when presented with the idea for the volume, Jesper’s long-time colleague Claus Emmeche humorously (and approvingly) envisioned it as “a possible blend of a Catechism, Quotations from Chairman Mao (aka the Little Red Book) and the *I Ching*”.

In the end, over 80 world-class scholars responded positively to the request to “select a short quotation taken from any of Jesper Hoffmeyer’s texts and to provide your own scholarly commentary upon that passage – whether in the form of an analytical explication, a critical disagreement or a conceptual extension – that you feel asks the questions that need to be asked, proposes the ideas that need to be proposed, or that draws out the implications that need to be so explicitly drawn out, germane to the claims of the selected passage” and, as the following pages so well attest, the result has turned out to be even more gratifying and fruitful than Claus and the editors had originally envisioned.

The resulting volume is a collection, not of full-fledged arguments, but of a series of brief, suggestive intellectual ‘triggers’ inspired by the work of Jesper Hoffmeyer, and designed to, in the words of Ludwig Wittgenstein, “not spare other people the trouble of thinking; but, if possible, stimulate someone to thoughts of his own” (1953: x^c). There can be few more perfect encapsulations of the spirit of Jesper Hoffmeyer, and of his public project in the world, than these humble and, like Jesper’s, militantly human words, taken from the preface of *Philosophical Investigations*.

In a similar spirit, Jesper’s lifelong commitment to simplicity and elegance in his writing – a commitment born of an utter lack of need or desire to obfuscate one’s point, or to substitute mere sentence-writing for thinking, no matter how deep or difficult the topic – was the inspiration behind the idea of titling each of these commemorative tributes with a single word, much in the way that Jesper chose to title his own chapters (e.g., “Defining”, “Signifying”

and “Uniting”) in his landmark volume, *Signs of Meaning in the Universe*.

The result reads like a tantalizing Index of Hoffmeyerian Ideas, with its range and depth a tribute to Jesper’s own wide range and depth of thinking and its scope and indication of the range and depth of the influence of his thought on others. At once a celebration and a serious academic development of the work of Jesper Hoffmeyer, with this volume we mark the occasion of his 70th birthday on February 21, 2012.

Every author in this book has been deeply inspired by Jesper Hoffmeyer – all by his words, and many by his friendship. Both are signs of an abiding reality that is vaster and more profound than we can ever give expression to. But as Jesper, of all people, knows: we all must yet do whatever little that we can.

“The sign is itself a kind of pier,” writes Jesper, “uniting ‘something’ with ‘someone’” (1996: 143). United by the signs you’ve given us, Jesper, we hereby give our own consequently developed signs back to you – and send them out into the world for even further development, just as both your biosemiotic principles and your example have taught us to do.

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AGENCY

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*To ask for the origin of life is to ask for the origin of the environment. Living organisms are inscribed in their environments much like patterns woven into a carpet. The two cannot get apart, and yet there seems to be a distinct asymmetry in their relation.*¹

As in much of Hoffmeyer's seminal work, this short citation has an underlying initial assumption and a number of robust implications. In this brief contribution, it is my intention to make those implications explicit.

In today's mainstream scientific thinking, entities and activities are studied in isolation – such that their structural and functional properties are assumed not to change in relation to every environmental setting in which they may be expressed. When Hoffmeyer states that the origin of life is inseparable from the origin of the environment, he is not referring to 'life's properties' (whatever they may be), but to the *relationships* that living entities are capable of entertaining with their surroundings. Taking such relationship as a primitive condition implies that no life could ever have emerged unless it was allowed to explore the external milieu as a pre-requisite for its own self-description. Hoffmeyer refers to this condition as a *relative being* – in opposition to the idea that something could exist per se without any reference to otherness. Thus, rather than looking at self-replication as an essential requirement for life – as most molecular biologists would do these days – Hoffmeyer is

¹ Hoffmeyer, Jesper 1998. Surfaces inside surfaces: On the origin of agency and life. *Cybernetics & Human Knowing* 5: 33–42 (p. 35).

advancing the view that life is built on the fundamental asymmetry of a topological closure.

For if surfaces are ontologically primary structures, it then follows that the enclosed entity is offered the opportunity to define itself in relation to whatever is external to it – i. e., of self-describing its own relational autonomy. This entails that the internal space is always enabled to grow and differentiate, as a spatially confined and temporally extended entity, in relation to an ever changing and unpredictable environment. In spite of this apparently paradoxical view, a number of implications can be logically drawn from this initial assumption.

Persistence of an inside/outside asymmetry allows the internally confined space to grow in complexity and to be indefinitely maintained far from thermodynamic equilibrium. Such topological asymmetry provides an energetically favorable situation for creating a developmental path-dependency sufficient to counteract any entropic decay and catastrophic degradation.

But even persistence itself may be jeopardized, if simply maintained on an individual scale. To be maintained in time and to overcome any decay, the topologically confined entity has to upgrade its self-description from an analogical type of record to a digital one. This implies that memory of its environmental coupling cannot be simply recorded as it is accomplished in action, i.e. as a rate-dependent morphological change. Rather, it has to be stored in an indelible, molecularly inert, and digitalized form – that is, encoded in a rate-independent manner. This is what Hoffmeyer and Emmeche have come to call *code-duality* (Hoffmeyer, Emmeche 1991: 121). Whatever the nature or the order by which environmental interactions are experienced by the living entity, digitalization in the form of DNA allows information to be stored in such a way as to be always accessible, regardless of the time of initial experience and the extent of recombination. Recognizing the primacy of self-description implies conferring the role of *agent* to the enclosed entity – agency being defined as the capability of interacting as a subject with the external milieu.

One way of conceiving of these agents' interactions could be as resulting simply from the properties of the interacting partners, and as such they could be thought to be entirely predictable on the basis of prior knowledge. But here Hoffmeyer takes the view that

interactions are emergent with respect to the partners' properties, and, as a result, they cannot be deduced from, or guided by, the conformity to general laws (Salmon 1998: 127). On the contrary, any relationship has to be understood as temporally situated, as creative with respect to antecedents, and driven only by local contingency. On conceptual grounds, this is not to deny any causal values to these partners' properties, but simply to reduce their role to that of a necessary, though not sufficient, condition for the interaction to occur – therefore leaving the character of an emerging novelty to the contingency of their interaction.

What then could an agent do whenever confronted with an unstable and unpredictable surrounding? Hoffmeyer refers to the possibility of the agent to interpret meaningfully any message that may cross, either inwardly or outwardly, the membranes enclosing living systems (Hoffmeyer 1998: 36). *Interpretation* in this context does not necessary imply 'self-awareness' or an elaborate knowledge of the contextual setting, but simply the ability to sense the exchange of messages, through the exposed interfaces, as signs satisfying their need for completeness. Any environmental sensing that proved capable of fulfilling their metabolic requirements would then be interpreted as a meaningful sign matching their expected survival needs.

In conclusion, due the topological asymmetry of cell membranes and to their ontological role in defining the primacy of self-description, living entities are endowed with the *semiotic competence* to recognize and respond to emerging novelties. Given the possibility of fixing these novelties into digitalized memories, living entities are thus offered the chance of anticipating a foreseeable future in which the present incompleteness could be possibly satisfied. Any self-description they may attain through genetically fixed records has to serve as a present memory; while, to cite Jonas (2001: 14), any analogical expression is somehow anticipating their role as *agents* exploring the basic dimension of a *needful freedom*. In Hoffmeyer's biosemiotic thinking, this confirms the essential life property of making the initial spatial asymmetry of cell membranes functionally equivalent to a temporal surface endowed with the ability to develop an agentive role.

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*The evolutionary trend toward the production of life forms with an increasing interpretative capacity or semiotic freedom implies that the production of meaning has become an essential survival parameter in later stages of evolution.*¹

Is it ‘nature’ or ‘nurture’ that influences human behaviour? Nowadays, most psychologists would probably acknowledge the impact of both nature *and* nurture when it comes to behavioural outcomes. However, there is still widespread belief in the idea of the environment (nurture) and genes (nature) influencing behaviour via mutually exclusive pathways. Researchers now know that these influences are highly interdependent, and that experience and environment (nurture) can modify genes (nature) in ways, which, in some cases, can also be passed on to subsequent generations. The field dedicated to studying such processes is called *epigenetics*, since its focus is on the role of experience-dependent variations in gene transcription. This paper aims to provide a brief review of how a particular type of computational search heuristic, called a *genetic algorithm*, may benefit from implementing insights from both epigenetics and biosemiotics – and in particular, Jesper Hoffmeyer’s notion of *semiotic freedom*.

Experience shapes behaviour and memory, and the general idea behind epigenetic mechanisms playing a causally deterministic role in cognition was first postulated by Francis Crick in 1984. Chemical modification to the DNA molecule can affect cognition, for example,

¹ Hoffmeyer, Jesper 2010. A biosemiotic approach to the question of meaning. *Zygon* 45(2): 367–390 (p. 367).

and abnormal DNA methylation can lead to severe cognitive impairments that can be found in conditions such as Alzheimer's disease and Rett syndrome (see Levenson, Sweatt, 2005 for an excellent review). DNA methylation is the term given to the biochemical process of altering a strand of DNA by means of a methyl group (CH_3) added to a cytosine molecule, which is a pyrimidine derivative and is a base found in both DNA and RNA. In some cases, such methylation of cytosine molecules can lead to gene suppression, which is a way of regulating gene expression. And these changes in DNA methylation can also be inherited, via mitotic and meiotic cell division (Day, Sweatt 2010: 1320).

According to Hoffmeyer (2010: 367), natural selection would have a favourable effect on the evolution of more advanced forms of semiotic freedom, given the advantages accompanying being able to more readily react to a wider range of signs. Hoffmeyer's proposal seems plausible, given that there is a greater likelihood for an organism to pass on their genes if they can successfully adapt to their environment, which greater interpretative capacity would seem to promote. Given what we now know about epigenetic development and semiotic freedom, I propose that we now have the opportunity for this knowledge to be implemented in developing the next generation of genetic algorithms for running on a computer.

"Genetic algorithms" are a special class of computational search heuristics that attempt to emulate the natural selection process in order to, among other things, find optimal solutions to problems from a large pool of potential solutions (Goldberg 1989: 24). For example: pharmacological researchers may use genetic algorithms in order to identify molecules that could be useful in developing new drugs. This type of process would typically start with the researcher explicitly outlining the initial environmental parameters of the potential candidate molecules. The genetic algorithm then generates a random set of "solutions" which satisfy the initial environmental constraints. The researcher can then rate the molecules generated based on several key characteristics associated with the requirements for a molecule appropriate for the given constraints. This is usually performed by the researcher, who has to rate several characteristics for each and every molecule generated by using a Likert-type scale ranging from 1 to 5, leading to each molecule receiving an overall score, which is then fed back into the process.

Using this information, the genetic algorithm then generates *another* set of candidate molecules to be rated, so that this iterative process continues for several generations, until there is evidence of convergence towards a single candidate molecule. During each generation, the fitness of every potential solution is measured. Thus, this process contains a deterministic, as well as a stochastic, component – and similar techniques are also used in automotive and aerospace design. However, a limitation of this approach is that the evolutionary assumptions made by the genetic algorithm in order to generate the next generation of potential solutions is often poorly defined and lacks internal consistency.

An epigenetically- and biosemiotically-inspired genetic algorithm, however, could be one that radically changes the way that nature and nurture are represented as mutually exclusive systems, in the form of “genetic material” being passed from one generation to the next (*nature*) in an environment (*nurture*) defined by the initial parameter settings. In traditional genetic algorithms, there are no genuine higher-order interactions between these “nature” and “nurture” elements. This may be sufficient for well-defined search heuristic requirements, however, in the case of developing search heuristics for innovative product design solutions (for example, where the aim is to strive for a radically innovative solution, as opposed to a new product design that is incrementally superior than its predecessors), it may be particularly important to develop an *integrative* module that computationally *emerges* from an interaction between the initial environmental parameters and the internal structure of the solution itself.

Applying artificial neural networks would be ideal for such a task, given their ability to linearly and non-linearly transform input data (in this case from the environmental parameters and the internal structures) to emergent output data, comprising the novel epigenetic component to genetic algorithms. However, a critical aspect of this computational modelling strategy would be to have the notion of *interpretative capacity* or *semiotic freedom* (perhaps rated by a human or by using adaptive natural language processors) as the essential ‘survival parameter’ determining which product solutions successfully transition from one generation to the next and continue down the path of evolutionary convergence until an optimal solution is found.

The above approach would establish a novel *meaning-driven* evolutionary design strategy, inspired by “production of meaning [as] essential survival parameter” model that Jesper Hoffmeyer so writes about so profoundly in the quote that begins this article, and may enable the discovery of even more innovative solutions, by using such biosemiotically-inspired genetic algorithms as search heuristics.

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ALTERITY

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For the idea that personality has a place, a topological site, is not especially obvious, and by its very nature cannot be scientifically confirmed. The simple fact that our personhood “presupposes” our brain does not imply that our personhood is in the brain – and should we feel so compelled as to finally place our personhood in a definite biological locus, why not place it in the skin? For this is where we encounter the world around us and, in so many very obvious instances, the place where “all the fun” occurs. And, in fact, the skin is an indispensable part of our personality.¹

I’m very happy to contribute to this publication on the occasion of Jesper Hoffmeyer’s 70th birthday. We were born in the same year, the same month and under the same sign, Aquarius. From different intellectual perspectives, developing different interests, and reading different authors we have come to the same conclusion: the other is in the self, the relation with the external other presupposes the relation with the internal other.

Hoffmeyer cites Merleau-Ponty (2002, cited in Hoffmeyer 2008: 174): “The evidence of the other is possible because I am not transparent to myself and because my subjectivity pulls its body behind it”. I will now extend Hoffmeyer’s conception, reading it together with Levinas and Bakhtin. The author is in my skin, says Emmanuel Levinas (the author I began reading first in my philosophical studies). In ‘Reality and its Shadow’, Levinas writes: “Being is not only itself, it escapes itself. Here is a person who is what he is; but he does not make us forget, does not absorb, cover

¹ Hoffmeyer, Jesper 2008. The semiotic body. *Biosemiotics* 1(2): 169–190 (pp. 171–172).

over entirely the objects he holds and the way he holds them, his gestures, limbs, gaze, thought, skin, which escape from under the identity of his substance, which like a torn sack is unable to contain them” (Levinas 1987: 6).

Otherness is in the self, itself a dialogue, a relation between same and other. The other is inseparable from the “I”, the same (*Même*). As the absolutely other, it cannot be included in the totality of the same. The other is necessary to the constitution of the I and its world – but is at once refractory to all those categories that tend to eliminate and subject it to identity of the same.

Otherness presents a constitutive impediment to the integrity, closure of the I as Identity, totality, the same. The relation with the other is characterized by excess, *excedance*. As Levinas reminds us: “The principal task behind all these efforts consists in thinking the Other-in-the-Same [*l’Autre-dans-le-même*] without thinking the Other [*l’Autre*] as an other Same [*Même*]. The *in* does not signify an assimilation: the Other disturbs or awakens the Same; the Other troubles the Same, or inspires the Same, or the Same desires the Other, or awaits him [...] *the identity of the Same is not that to which all his meaning can be reduced*. The Same contains more than he can contain” (Levinas 1998: 80).

The I is opening to otherwise than being, to the outside, without shelter, homelessness, worldlessness, without security. But opening is not only negation: it also signifies the other side of identity, of inwardness, demythization of the self, before closure in the abstract notions of freedom and non-freedom, when self is not yet nailed to the I.

Identity is exposition, without deliberation which in itself would already be closure in identity with its illusory barricades. This means that self cannot be indifferent. Non-indifference is a passivity. It penetrates identity even in the retreats of its inwardness. “The exposure precedes the initiative a voluntary subject would take to expose itself” (Levinas 1998: 80). It opens on to the world but is not in-the-world, is nonbeing in the-world. The restlessness of passivity – a passivity more passive still than the passivity of matter – in exposure to an other, restlessness which takes place without a decision, is restlessness in exposure to an other exposure, to the openness of a face, the face of the other, the openness of its nudity.

Exposure to an other is the asymmetric relation in the face-to-face position. Face-to-face position is exposition of one's nudity, outside role, position, function, power, defense. It is my relation in my alterity to the other in his alterity. Alterity in the face-to-face exposition is not relative alterity of roles, positions, functions, power, but absolute alterity. Exposure of one alterity to another alterity in the face-to-face relation precedes identity, subjectivity, freedom, language, being and it is their condition.

Concerning Bakhtin, dialogue is not communication of messages, nor initiative taken by self. Instead, self is always in dialogue with the other, the world, whether it knows it or not; self is always in dialogue with the word of the other. Identity is dialogic. Dialogism is at the very heart of the self. The self, 'the semiotic self', is dialogic in the sense of a species-specific modeled involvement with the world and with others. Self is implied dialogically in otherness, just as the 'grotesque body' (see Bakhtin 1984) is implied in the body of other living beings. From a Bakhtinian perspective *dialogue* and *intercorporeity* are interconnected: there cannot be dialogue among disembodied minds, nor can dialogism be understood separately from the biosemiotic conception of sign.

With the shift from identity (whether individual or collective) to alterity, a sort of *Copernican revolution* is accomplished. Bakhtin's 'Copernican revolution' concerning the self, identity, consciousness involves all living beings, not only in the human world, but extensively in the biological. Consciousness implies a dialogic relation, including witness and judge: "When consciousness appeared in the world (in existence) and, perhaps, when biological life appeared (perhaps not only animals, but trees and grass also witness and judge), the world (existence) changed radically. A stone is still stony and the sun still sunny, but the event of existence as a whole (unfinalized) becomes completely different because a new and major character in this event appears for the first time on the scene of earthly existence – the witness and the judge. And the sun, while remaining physically the same, has changed because it has begun to be cognized by the witness and the judge. It has stopped simply being and has started being in itself and for itself [...] as Well as for the other, because it has been reflected in the consciousness of the other [...]" (Bakhtin 1981: 137).

Bakhtin's dialogism can be associated with Sebeok's biosemiotics. They both believe that all living beings are interrelated in spite of apparent autonomy and separation.

Modeling and dialogism are pivotal concepts in the study of semiosis. Communication is only one type of semiosis that, with the semiosis of information or signification of symptomization, presupposes the semiosis of modelling and dialogism.

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ANTHROPOSEMIOTICS

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*Clearly the import to the natural sciences of concepts developed inside humanistic disciplines like linguistics and semiotics is bound to provoke criticism (for some reason import the other way round is generally much more easily accepted, e.g. 'psychological energy', 'social homeostasis').*¹

Jakob von Uexküll, similar to Monsieur Jourdain, invented bio-semiotics without knowing it; Tom Sebeok also dabbled in it; but it only came into force with the work of Jesper Hoffmeyer. It seems that Sebeok already used the complementary term anthroposemiotics a couple of times, but it was Hoffmeyer who acquainted me with it, using it as a kind of a short-hand for all the things he did not care to study. Like pragmatics, as Yehoshua Bar-Hillel once said, it has become as vast waste-basket.

From one day to another, I discovered myself to be an anthroposemiotician, and of course I was embarrassed. My first reaction was to think that, since human beings are animals, anthroposemiotics could only be a part of biosemiotics. But, of course, it must be a particular part. Not only because we, who are in the business of formulating such questions, are human beings ourselves, but, because of being human, we are the only ones able to study other animals – and then, as a kind of a bonus, ourselves. So I discovered a task for anthroposemiotics: to find out why human beings are such

¹ Hoffmeyer, Jesper and Emmeche Claus 1991. Code-duality and the semiotics of nature. In: Anderson, Myrdene; Merrell, Floyd (eds.), *On Semiotic Modeling*. Berlin: Mouton de Gruyter, 117–166 (p. 153).

peculiar animals. There is continuity between us and the rest of the animal kingdom, but there is also discontinuity. Why?

If biosemiotics is understood as zoosemiotics, it is easy to see that there is a great deal of continuity from there to anthroposemiotics. For someone like me, who has, in later years, been involved with the study of other primates, that gap often seems to get ever smaller. Can apes learn to handle signs – even if we define that notion much more strictly than Peirce and biosemiotics do – i.e. as something analogous to words and pictures? Well, those apes that are taught some substitute for language certainly can, but there are also indications that apes may use signs *without* having had any language training. Children, in turn, only slowly learn to use signs, and the first ones they master are certainly not linguistic signs. Using the vague notion of ‘sign’ that is current in biosemiotics, we unfortunately have no way of stating this.

Taking Sebeok’s idea of endosemiosis much further than he himself did (or lived to do), Jesper Hoffmeyer also inaugurated biosemiotics as the study of meaning internal to cells. This creates a problem for us anthroposemioticians, for the continuity from cells to that peculiar ape called a human being is very difficult to perceive. No matter how much emergence and degrees of freedom we introduce, it does not seem to add up. Perhaps we could agree that life itself is meaning, but then we still have to bridge the distance from meaning to signs.

Paradoxically, Hoffmeyer sometimes claims (though not with these very words) to be using an anthroposemiotic model in order to understand biosemiotics. Indeed, he is very content to reverse the accustomed order of reduction: instead of using a model developed in the natural sciences to study things which are ordinarily the subject of inquiry in the humanities, he employs a model derived from the humanities to study the customary objects of the natural sciences. But is there a difference between reducing signs to cells and cells to signs? We are, of course, more used to the former kind of reduction, such as when signs and ideas are called ‘memes’, so as to become more or less identified with genes. But to quote Hoffmeyer quoting Bateson (who may be quoting Gustav Bergmann): What about ‘the difference that makes a difference’? Isn’t it lost in both kinds of translation?

No doubt, models and metaphors are asymmetrical. There is a difference between taking the known properties of a sign and transferring them to a cell, and taking the known properties of a cell and transfer them to a sign. The claim that the butcher is a surgeon is quite different (*pace* Lakoff) from the claim that the surgeon is a butcher. And, yet, in some ways, both comparisons amount to the same thing. In both cases, we are left wondering what the difference is. This may be no problem in the case of the butcher and the surgeon, which are defined for us by our society – but it may be an issue with reference to signs and cells. Metaphors should retain their mysterious ring. But scientific models have to account for both the similarities *and* the differences.

Comparisons are important. But so are distinctions. On this 70th anniversary, what I wish for Jesper is a life beyond signs. Or more precisely: the discovery that life may be meaning, without yet being a sign. In spite of Peirce, the ethics of terminology should teach us much. Only then will the marriage of anthroposemiotics and bio-semiotics be truly consummated.

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- Hoffmeyer, Jesper and Emmeche Claus 1991. Code-duality and the semiotics of nature. In: Anderson, Myrdene; Merrell, Floyd (eds.), *On Semiotic Modeling*. Berlin: Mouton de Gruyter, 117–166.

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I en biosemiotisk forståelse er mening og betydning (sema) indbygget i kroppens natur (soma) og er ikke aspekter, der kan outsources til en ubestemt lokalitet i hjernen eller psyken. Uanset hva det psykiske end er, så er det også krop. Ikke krop i den fysiske forstand, videnskaben hidtil har begrænset kroppen til, men kropp i en semiotisk forstand; dvs. en krop, hvis hele dynamik er indlejret i det kommunikative samspil hen over de overflader, der omgiver celler, væv og organer i kroppen så vel som kroppen selv som enhed i det større sociale spil, den indgår i.¹

In the quote above, Jesper Hoffmeyer states that in a biosemiotic understanding, meaning and significance (*sema*) are part of the nature of the body (*soma*), and not aspects that can be outsourced to a locality in the brain or to the psyche. Whatever the psyche is, he posits here, it is also body – although not a ‘body’ in the common scientific understanding of the word, but a semiotic body: i.e., a dynamical body which exists as a communicative interrelationness on the surfaces of surrounding cells, tissues and organs in the body, as well as the body itself as a unity in the larger social play that it is part of.

Thus, with these words, Jesper Hoffmeyer has given the humanistic disciplines a Body; a body that these disciplines cannot afford not to consider in the future.

Indeed, Hoffmeyer has defined this body in a popular and most well-formulated way in the quotation above. But how could this *semiotic body* be of interest to the aesthetic disciplines? The anthro-

¹ Hoffmeyer, Jesper 2011. Semiosphaeren. In: Skriver, Morten; Kjeldgaard, Inge Merete (eds.) 2011. *Livstegn. Kunst + biologi. Morten Skriver og Jesper Hoffmeyer*. (Katalog.) Esbjerg: Esbjerg Kunstmuseum, 19–20 (p. 19).

pologist Ellen Dissanayake, in her books *What is Art for?* (1988) and *Homo Aestheticus. Where Art Comes From and Why* (1995) argues that art has been central to human evolutionary adaptation, and that the aesthetic faculty is a basic psychological component of every human being. In general, however, the human sciences have been unwilling to associate art with biological life.

Dissanayake's perspective is bio-evolutionary, and art for her is a doing, a behaviour. As she emphasizes in her books, the view of art as a bio-evolutionary need has not been common in aesthetics. There is one philosopher, however, who long before Dissanayake held a comparable view, and this is the American philosopher and pragmatist John Dewey (1859–1952). In the one book he wrote on aesthetic theory, *Art and Experience* (1934), he presents a theory of aesthetic experience based on the argument that man needs the quality of art in his continual interactions with the surroundings. Dewey substantiates his theory by entering into dialogue with Charles S. Peirce and his ideas regarding evolution, abduction and sign action.

In *Art and Experience*, Dewey defines art as “a quality of doing and of what is done”. Art, according to him, “is an intrinsic quality of activity” (1980 [1934]: 214). Dewey's view of ‘art as doing’ is deeply bound to the position he gives experience. Since in Dewey's pragmatist aesthetics or, as Richard Shusterman (1992) puts it, in Dewey's “somatic naturalism”, art cannot be separated from the experience of it, and experience is connected with the organism's action and interaction with its environment. Art, in other words, has a basis in the organic world. The body is deeply involved in experience, and in the negotiations which go on between the human mind-body and its environment. This means that both the creator and the perceiver of the artwork are bodily involved in a process of interaction.

Art happens *in the body*, and imagination is involved as the “bridge” between the inner and the outer world of the human. A work of art lives in the qualitative experience of its materiality and outer circumstances. It is itself a total effect brought about by vibrations of light, etc. The receiver of an artwork is not a subject confronting an object, but him or herself imaginatively involved in the creative moment of the perception of the quality in the

experience; an interactive process that affects the content of awareness itself.

Knowledge, too, is a product of art, says Dewey in *Experience and Nature*, not vice versa (Dewey 1958: 382). He or she who “perceives aesthetically will create an experience of which the intrinsic subject matter, the substance is new” (Dewey 1980 [1934]: 108). Thus, the uniqueness and spontaneity of the aesthetic experience does not primarily lie in the meaning of the artwork. In a Peircean terminology, we could say that the abductive action of the perceptual judgment is where the quality of aesthetic experience happens. This event has the character of immediacy.

If art is a qualitative experience that is important in evolution, what is the relation between this qualitative immediacy and Hoffmeyer’s emphases, in the same catalogue, of agency and will? Does agency and will in humans have to do with qualitative immediacy? Is qualitative immediacy simply the underpinning of agency in higher forms of life? If so, then art could be one possible sort of outbreak of the spontaneity or semiotic freedom, which Hoffmeyer has so eloquently argued to be of such necessity in evolution.

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BACTERIA

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*When a bacterium cell finds itself in a gradient of nutrients and swims right instead of left, the cell is making a choice.*¹

How to understand this quote by Jesper Hoffmeyer?

According to current microbiological knowledge, the motility of a bacterium such as *Escherichia coli* can be described as follows: the bacterium is able to make two movements: keep moving in the same direction, or change directionality. Through a complex system of receptors, the bacterium periodically monitors the concentration of a certain chemical element in the surrounding environment. If the bacterium ‘realizes’ that it is moving along a positive gradient, then it keeps moving in the same direction; if, on the contrary, it ‘realizes’ that it is moving along a negative gradient, for instance from areas with more food toward areas with less food, then it changes direction.

This motility dynamic reveals at least two interesting aspects. The first is that the bacterium must be able to compare its present state with the immediately previous one. Therefore, it must be endowed with a (albeit very rudimentary) form of memory. The second aspect is that the bacterium must be able to change direction. But the question to be asked, then, is the following: When a bacterium changes the direction of its motility, how is the new directionality determined in relation to the previous one?

¹ Hoffmeyer, Jesper 2010. Semiotic freedom: An emerging force. In: Davies, Paul; Gregersen, Niels Henrik (eds.), *Information and the Nature of Reality: From Physics to Metaphysics*. Cambridge: Cambridge University Press, 185–204 (p. 194).

Current microbiological knowledge claims that such change is ‘random’ – that is, due to chance. But if it is claimed that the choice of direction of the bacterium is not necessary, since it cannot know in advance in which direction it will come across a more favorable gradient, then it is implicitly admitted that the bacterium’s choice of directionality is, from a certain point of view, free. The bacterium can therefore “choose” – and I believe that this is the sense of the term that Jesper Hoffmeyer is employing – where to move when searching for a better environment. Hence, one can elaborate a sort of micro-semiotics of bacterial motility, in that changes in the directionality of this motility seem not to be reducible to pure necessity.

Let us consider now the motility of a human being who walks through a city in order to move from home to work. Contemporary semiotics tends to include such a phenomenon among its possible objects of study. Indeed, the network of urban streets can be analyzed as a system of potential alternatives, in relation to which each crossing, be it pedestrian or of another kind, actualizes a possible path. The ‘meaning’ of such a path, and therefore its being analyzable through semiotics, exactly stems from its being opposed to a whole series of alternative crossings: some will choose the shortest way from home to office, others the one with less traffic lights, yet others the one with more monuments or green areas, and so on – so that a more or less determined meaning will correspond to each of these choices, precisely by virtue of its being in contrast with a system of discarded alternatives.

Hence, one might wonder whether freedom of choice in the coming about of a crossing is an essential requirement of its appearing as an object of meaning. The answer is certainly positive: if the citizen was obliged by nature to always go the same way, then such a way would have no meaning whatsoever, since it could not be opposed to any alternative one. But one might also wonder what the quality of this freedom of choice is from the semiotic perspective. From the semiotic point of view, it is not absolute freedom, but freedom in relation to a system of potentialities; freedom that is, so to speak, limited by the matrix of crossings offered to citizens by the network of urban roads as a consequence of the complex historical vicissitudes of its development. At each moment, the citizen can chose whether to stop or to keep moving,

and in this second case in what direction to keep moving. Yet, such freedom is not infinite, but always bound to a finite system of potentialities. Finally, one might wonder what pushes the citizen to change direction in one way or another. Several hypotheses can be formulated to this regard, but the ultimate answer will be, in most circumstances, that it is *random walking* – as mathematicians designate this kind of stochastic phenomena – i.e., the reasons for which a citizen chooses to turn right instead of left are impossible to determine.

Going back to bacteria, what is the deep difference, then, that distinguishes their motility from that of human beings? In both cases, motility cannot be explained without an – albeit minimal – reference to the concept of choice, and therefore to that of freedom. In both cases, though, the conception of such choice, as well as that of the freedom it implies, seems to be subordinate to the concept of chance. It is only because we do not know the physical-chemical causes that necessarily determine changes of directionality in the motility of an *Escherichia coli* bacterium that we attribute such changes to chance, and therefore project onto them the possibility of a free choice among several alternatives. Similarly, it is only because we do not know the psychosocial causes that necessarily determine changes of directionality in the motility of a citizen that we attribute such changes to chance, and therefore imagine the possibility of meaning as stemming from the free actualization of one among several potentialities.

In contrast, one can formulate the hypothesis that, with the progress of micro-biological research, the bacterium will be more and more nailed to a series of necessary acts and that, analogously, with the advancement of psychosocial research, the human being will end up appearing as more free than a bacterium only in quantitative, but not in qualitative terms; that is, it will be more difficult to reduce human freedom to necessity, but only because of the number of factors to be considered, and not because of their quality. Thus, one will end up turning what seems a dice game into a chess game, to quote Marcel Duchamp, and chance will increasingly look like an old-fashioned concept, a sort of phlogiston, a measure of the deficit in the knowledge of things.

Following this trend one must wind up with a mechanistic conception of life, where the notion of freedom inevitably dis-

appears, or remains only in those cases where the determinations that necessarily impose a certain path to the motility of living beings cannot be grasped. Every kind of movement, then, from the one that swarms in the subatomic structure of *mineralia*, to the tropism of *vegetalia*, to the simple taxis of *bacteria*, and above all to the complex motility of *animalia* – human beings included – would be part of a complex mechanism whose formula would allow one not only to reconstruct the past of the universe, but also to foresee its future with certainty.

Yet, this absolutely deterministic and mechanistic perspective would neglect an element that is essential in the philosophy of the evolution. On the one hand, finding that at the heart of the motility of bacteria, and maybe also in the tropism of plants, not to speak of the swarming of the subatomic structure of the universe, subsists the same principle of actualization in relation to a matrix of potential alternatives allows one to embrace the whole universe in a single view, to be configured like the first embryo of a ‘theory of everything’. On the other hand, though, the identification of this common principle cannot distract one from considering that, throughout evolution, this same principle undergoes reconfigurations that subsequently alter its scope and, above all, its consequences, from the point of view of a philosophy (or even a metaphysics) of meaning. Let us consider, for instance, the difference between phototropism and phototaxis: in both cases, the living being tends to direct itself toward what is imposed to it as a positive polarity of the universe, that is, abundance of light as opposed to its scarcity.

Nevertheless, whereas in phototropism, for instance in that of vegetables, the living being cannot but grow in the direction of light, in phototaxis the living being can, in a certain sense, be mistaken. It can be mistaken because, albeit in the short instant in which it changes its directionality in relation to a previous path, it can, as a matter of fact, orient itself, by mistake, toward a point of the universe with less light. In short, the increased motility of the living being, besides being adaptive as it enables an active exploration of the universe instead of a passive reception of it, augments its potential of freedom, introducing a principle of choice.

Such principle of choice – as Jesper has shown in so much of his work – is the cradle of *semiosis* and, as a consequence, the cradle of humanity.

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BIRDSONG

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*Whenever a regular behavior or habit of an individual or species is interpreted as a sign by some other individuals (conspecific or alter-specific) and is reacted upon through the release of yet other regular behaviors or habits, we have a case of semethic interaction.*¹

The complexity of the natural world may be considered the result of a huge number of fluxes of matter, organisms and energy that are interconnected in some extension. This model is very popular in ecosystem ecology, but is not completely satisfactory and not sufficient to explain all the mechanisms by which, for example, animal species actively interact with one another.

A biosemiotic interpretation, such as the one proposed by Jesper Hoffmeyer above, seems to offer a more complete and satisfactory paradigm, especially to explain sign interactions between different species. For these interactions establish pathways that are themselves carriers of information-with-meaning. As Hoffmeyer (2008) argues, a communication net connects individuals of different species and it seems that a specific process creates the foundations for several hetero-specific habits. The interactions he describes in the quote above he has called ‘semethic’ (from the Greek, *semeion* = sign + *ethos* = habit) interactions.

Semethic interaction is one of the fundamental biosemiotic concepts that is extremely important to introduce into the realm of ecological study, where sign systems *per se* are rarely considered and evaluated. And in my own work, I have found this concept

¹ Hoffmeyer, Jesper 2008. The semiotic niche. *Journal of Mediterranean Ecology* 9: 5–30.

extremely useful to describe a world of active and adaptive conspecific and alter-specific acoustic communication. In particular, in the study of acoustic patterns between birds inside a community, we can invoke a semethic mechanism to explain the creation of a dynamic “*soundtope*” – which I define as an intentional, coordinated association of different singing birds that produces a communication net necessary to track some resources like food or security (Farina 2012).

The clustering of singing birds is quite common in nature, and could be produced by the effects of habitat heterogeneity on bird distribution. But if we understand that such heterogeneity is not recognized in the same way by different species because they each have specific *umwelten*, then the “habitat heterogeneity hypothesis” becomes contradictory and insufficient to explain such patterns.

Definitively, the hypothesis that the complexity of vegetation functions as a proxy for the bird sound clustering is not sufficiently convincing to explain the “soundtope” patterns observed. Rather, there is evidence that birds concentrate their acoustic cues in a specific place, but one that can change spatially according to the period of the day or the season. The ‘geographical’ and ‘temporal’ plasticity of a soundtope is a tangible proof that the cognitive nature of such a process is created by a mobile net of semethic communicative pathways necessary to maintain cohesion inside a bird community (Farina 2012).

However, even the semethic interactions based on the acoustic performances that have been found in a bird community, especially in the breeding season, cannot explain the dawn chorus. At that time, birds seem to sing independently of each other, producing an extensive overlap of the acoustic cues that results in a random portrait. Birds during the dawn chorus are still close to the roosting places and probably the selection, the day before, of a safe and appropriate roosting site, is a priority despite the acoustic quality of the environment. But immediately after that time, a few minutes later, birds move around and concentrate their acoustic activity in temporally favorable acoustic areas. Such behaviour produces a cluster of calls and songs that cannot be explained simply as territorial behaviour.

Instead, we can admit that species composing a community have semethic communication strategies with all the other species. This

creates cohesion in the community by informing each individual about the position and status of the other conspecific or alter-specific individuals. In fact, some species could be, in turn, more active in the sound performance than others that are more complementary, and this, too, cannot be explained with the usual acoustic models (e.g., the eavesdropping model proposed by Burt, Vehrencamp 2005) based on the individual territorial defense.

In sum, concepts that Jesper Hoffmeyer have given us, such as that of *semethic interaction*, are the baseline for further paradigms like the soundtope, and help open a “gran vista” on the ecological functioning of the animal communities.

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BLADDERWORTS

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*The tendency of natural science [is] to deny the ontological reality of relations [...] the self-organizing property of living systems is in opposition to the physicalist conception of nature [...]*¹

I was a very pleased recipient of a signed copy of Jesper Hoffmeyer's *Biosemiotics: An Examination into the Life of Signs and the Signs of Life* (2008) which I obtained at the Semiotic Society of America meeting in Houston, Texas, during those momentous and therefore unforgettable weeks when the stock market crashed. Within the first 30 pages, however, I became a puzzled reader, as the first example of the significance of signs in *Biosemiotics* is 'the semiotics of a slap' – based on human activity – while the first example of organization in an eco-niche, the indirect mutualism of bladderworts, gives no example of the contribution of semiosis to mutual causality. Why human semiotics, first of all, in order to illustrate biosemiotics in an eco-system? I suspected that herein lies an unresolved dilemma.

Humans have language, therefore there is always a high degree of descriptive symbolism mixed in with their sign use. Moreover, in the case of human beings, many signs are polysemous. The particular case presented is of a slap interpreted as anger, but it could have been a slap that was an accident. Or it could have arisen from sexual play. Yet another example of polysemy is that of slapstick comedy, where a slap that is not a slap. Then there are cultural variations in the use of slaps in human interaction. I am not enough

¹ Hoffmeyer, Jesper 2008. *Biosemiotics: An Examination into the Signs of Life and the Life of Signs*. Scranton: University of Scranton Press, p. 51.

of a Peirce scholar to know what Peirce thought about polysemy, but I do know that Peirce was more interested in applying semiosis to the determinacy of logic, than in the indeterminacy of social or psychological events. He was also more interested in the conscious appraisal in interpretation of signs, *synechism*, than he was of unconscious appraisal. Peirce died just before Freud's first English publication, and could not have known Freud's version of how polysemy in human dreams plays upon consciousness.

Thus, we do not see Peirce discuss the difference between conscious and non-conscious generalities in relation to changes of habit. Yet Peirce's notion of *habit* is a particularly important concept in biosemiotics because of its close, perhaps synonymous implication, with an 'interpretant'. The issue here is that Peirce, like Bateson, is primarily interested in change – yet habituated activity is, as Bateson points out, often 'sunken' or non-conscious activity, and therefore, an activity that is difficult to change *because* it is non-conscious (Bateson 1991: 137–138). Now biosemiotics is, surely, extremely interested in the precise conditions of change of habit, because change of habit effects how semiosis is linked to mutual causality in ecosystems – even among bladderworts.

Moreover, if we were to incorporate Bateson's insights, we would note that every message contains two elements, 'report' and 'command'. With the use of language, it is very much easier to represent a distinction between a report and a command, because it is possible to say "My report is not a command". Much as in slapstick, where a slap is not a slap, language use permits a negative in order to explain descriptive aspects of the sign – i.e. to say "*not*". Animals can also indicate that a 'nip' is not a 'bite', but their way of doing so is ambivalent, as the evidence of watching pups at play indicates: if the interaction of play results in 'nips' interpreted as bites, the pups at play cannot easily re-interpret the nips as 'not bites' and instead have to re-establish the rules of relationship (Bateson 1956).

The point remains that the triadic relations of signification in human semiotics are different from the pattern of determinacy in communication in the non-human animal world – as a result of humanity's overwhelming reliance on linguistic description. Lack of language makes non-human animals unable to take advantage of symbolism (Deacon 1997), and this largely limits their descriptive

forms of communication. In the animal world, the form of communication is largely injunctive; and most communication about activity is purposeful in an injunctive manner. Consider then the slap, not of the human, but of the beaver's tail. It tells that there is danger here, now. Animal signification connects a state of affairs directly to actions, and to specific things to be done in the face of those states of affairs (Millikan 2002: 507).

Meaning arises from recurrent usage of evident relations, and to recursion in their patterning, that is to say, patterns that are contextually redundant in relation to very specific times, types of occasion and locales. It is an enormous step from this sort of signification to a human 'belief' – which clearly involves the separation of indicative from imperative functions of the representational system (*ibid*). Yet, Millikan argues, the full meaning of a communication is not limited to such specificity. Though the initial meaning of a sign arises out of a percept-action loop originating in recurrent locales, this recursion provides a ground for *meaning extensions*, wherever translocation or distal sets of relations are represented in animal communication (Millikan 2004).

Hoffmeyer objects to Millikan's explanation, because Millikan relies too sweepingly on 'natural selection' as her selective process, and I suspect that most in the biosemiotics community would agree with him. On the other hand, a logical and epistemic cut of symbolic representation out of Peircean biosemiotics inevitably affects the triadicity of both icon and index. The dilemma is: Can biosemiotics live with such deep revisionism to Peirce's triadicity of relations? Kull has already proposed a graded approach to semiotics and identifies the following grades of semiotic sign systems: cellular, vegetative, animal, linguistic, cultural (Kull 2000).

Bateson's insights make Millikan more palatable, in that he takes Millikan-style generalizations about natural selection, and re-casts that process into a series of temporal levels (which he unfortunately labelled a 'hierarchy'), replete with boundaries, gaps and interfaces, at each level. Meaning that arises from contextual signification on each level of a recursive hierarchy, each with an interface, also turns out to be a flexible way of discussing the semiotic contexts of habit, expectancy and surprise (information) – and hence of change, because 'habit' can then be examined in Bateson's own triad, the context of 'learning' (Bateson 1991).

For all that, bladderworts and their pattern of indirect mutualism begins Jesper Hoffmeyer's truly satisfying biological tour into that which Kant called the beauty of the sublime in nature – form, perception, connectivity, awareness, and a totally new understanding of active response of organism to the turbulence of environment and evolution. At the end of the tour, a new conception of the relation between nature and culture: no longer a dualism, but a continuum in which culture is an extension of nature: a consilience to be treasured! May Hoffmeyer's challenge to the fallacies of eugenics, sociobiology, and evolutionary psychology – and even the biochemical diehards in molecular biology – long remain!

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BODIES

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... if we are to be healed, the only way this can be achieved is through the acceptance of the fact that our intelligence swarms out of our bodies...¹

Susanne Langer's analysis of the 'great shift' to humanization, charted in her monumental trilogy, *Mind: An Essay on Human Feeling* (Langer 1967, 1972, 1982) intersects with and strengthens, both conceptually and empirically, Hoffmeyer's Peirce-based charting of the fundamental movement from the iconic and indexical orders to the symbolic order. The points of intersection merit close attention: (a) an attack on both substance dualism and materialistic monism, (b) recognition of the cerebral, hence bodily, aspects of the 'great shift' to human mentality due to an intracerebral surplus of images, (c) a foregrounding of the role of abstraction rooted in a primordial grasp of form and structure, (d) an acceptance of multiple and irreducible symbolic modes defining the space of anthropo-semiosis, and (e) a rich phenomenology of meaning-systems rooted in the fundamental semiotic distinction between discursivity and presentationality.

Langer arrives at conclusions practically identical to Hoffmeyer's, but she does not propose to apply a Peircean semiotic schema to the data, nor redescribe them in Peircean terms, although her own analyses duplicate Peirce's in many ways. Hoffmeyer recognizes the importance of Langer's work, especially her analyses of art, which he traces rightly back to the phenomenon of 'felt life' –

¹ Hoffmeyer, Jesper 1996. *Signs of Meaning in the Universe*. (Haveland, B. J., trans.) Bloomington: Indiana University Press, p. 136.

whose ‘morphology’, in Langer’s terms, it is the goal of art to objectify in pregnant images. Art for Langer is thus the objectification of feeling and the subjectification of nature. Langer shows that the life of feeling made manifest in art is held together by a rhythmic concatenation of integrated elements that are progressively more and more unified, giving rise to the essentially embodied agent as a vital matrix. An organism, and the mind as the locus or field of semiosis, she writes, is “made entirely by processes which are vital acts” and “the body, throughout life, is the ‘dynamic equilibrium’ itself, growing and differentiating into articulate forms” (Langer 1967: 184). A fruitful task would be to follow up these pointers, to explore in more detail the bodily matrices of artistic images, and to investigate these images as heuristic keys to exploring minding itself and its roots in vital processes of feeling.

Similar to Hoffmeyer, also, Ernst Cassirer, in his *Philosophy of Symbolic Forms* (1923, 1925, 1929), proposed a triadic schema of the symbolic niche created and occupied by humans. But Cassirer’s triad is not the Peircean one of iconicity, indexicality, and symbolicity, but one of *Ausdruck*, *Darstellung*, and *Bedeutung* – we could translate as *expression*, *representation*, and *pure signification*. The criterion for distinguishing between these signifying modes or dimensions is the relative freedom of the sign from the perceptual-intuitive level, from which it can never be totally dissociated. The sign’s body can never be left behind, any more than we can leave our own bodies behind. All three dimensions, at the productive level of articulation, including material articulation, belong to the ‘mid-world’ between the *Merknetz* and the *Wirknetz* of the other animals. Cassirer, explicitly referring to Uexküll, was aware of what we would call today a ‘biosemiotic’ framework, although his focus was the human ‘semiotic animal’. Cassirer’s consequent semiotic schematization of ‘technics’ in his seminal monograph, *Form und Technik* (1930), throws a helpful light on Hoffmeyer’s insistence on the normative role of *semiotic freedom*. Cassirer distinguishes, in accordance with his semiotic schema, between *mimetic*, *analogical*, and *signifying* technologies. Evaluating their lived consequences forces us to attend critically to (a) the types of experiences generated by these technologies and (b) their ‘quality’ of enabling us to move freely, with inner and outer richness, in the biosphere.

I think that Cassirer's great insights, both conceptual and evaluational, would support, complement, and extend in a genuinely 'semiotic' manner Hoffmeyer's own concerns for the 'health' of the biosphere as impacted by our technologies. The semiotic body must preserve its health both endosomatically and exosomatically, so questions that we may want to ask ourselves are: Is there such a thing as 'semiotic health?' In what senses is it possible for the great exosomatic systems of signs, tools, and models that make up the semiosphere to be 'sick?' What normative ideals underlie the ecological notion of 'imbalance?' Are these ideals implicit in semiosis itself? Is there maybe even a 'semiopathic' medicine?

Hoffmeyer has established that meaning is always rooted in, and structures, some sort of 'body'. Our natural bodies have a semiotic structure, as do our exosomatic bodies. Dwelling in our natural bodies, as matrices of meaning, we also dwell in our extended exosomatic bodies. Embodiment, in both cases, is essentially perilous. Michael Polanyi, in a pregnant passage from his *The Tacit Dimension*, exemplifies this in a most perspicuous way:

"The structure of tacit knowing [...] shows that all thought contains components of which we are subsidiarily aware in the focal content of our thinking, and that all thought dwells in its subsidiaries, as if they were parts of our body. Hence thinking is not only necessarily intentional, as Brentano has taught: it is also necessarily fraught with the roots that it embodies. It has a *from-to* structure" (Polanyi 1966: xviii).

These roots are multiform, encompassing all the dimensions of our dual embodiment. Polanyi's nuanced epistemological framework allows us to see that novel systems of signs and meanings and novel technologies, including new technologies of the media, are indwelt and treated as extensions of our bodily equipment. They define novel forms of world-making, from which and through which we attend to and interact with the world. These roots are the enabling and constraining conditions of the primary 'biases' of perception in the extended sense. There is a deep inertial drag in these embodied commitments. Their originating matrices contain forces - psychological, economic, political - that can destroy the health of biosphere and semiosphere alike.

Jesper Hoffmeyer, from the beginning of his career, has pointed out just what these commitments are and the risks involved in

making them. We often make them without even wanting explicit awareness of their consequences. Hoffmeyer's goal is precisely to raise, in a theoretical, critical, and practical way, our awareness and to show us, without hectoring and with the deepest ethical concern, what is at stake in the embodied circuit of transactions joining the biosphere, the semiosphere, and the technosphere in the great spiral of creation and destruction that marks life on this planet.

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PROOF

CATEGORIES

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*Reflections on the emergence of life necessarily brings us to the problem of discontinuity and continuity: Should we choose to see life as just one particular instantiation of more general tendencies characteristic to the universe we inhabit, or should we rather choose to see living systems as decisively different from anything else in the known world?*¹

As a colleague who has also been trained in biochemistry and molecular biology, I have long admired Jesper Hoffmeyer's linguistic dexterity in expressing intricate concepts in plain language. And the above quote from his 2001 paper 'Life and reference' is even more cogent today. During the intervening decade, the success of molecular biology has been amplified manyfold. The manifold of biochemical relationships among the various '-omics' created during this very productive decade has deluged us with data without substantially deepening our understanding of our origins.

For several decades, I explored the biochemical, dynamical, and informational basis of mutation, as a path for my contribution to public health. The central mystery that captivated my curiosity was the realistic question of: How was it possible that a single molecule could induce a biological mutation that changed the entire organism? The initial conjecture was well grounded in empirical evidence and fits well within the paradigms of genomics of today. Today, however, the same question would be phrased in terms of dynamical systems theory and information theory.

¹ Hoffmeyer, Jesper 2001. Life and reference. *Biosystems* 60: 123–130.

The physical mystery regards discovering what is the antecedent quality of chemical information such that it amplifies itself. The degree of informative amplification may be from 16 to 30 orders of magnitude, depending on the size of the living organism. The predicate logic of traditional mathematics (manifesting itself in theories of thermodynamics, quantum mechanics and information theory) does not offer any concrete calculations that inform us about the magnitude of such amplification. These physical theories do not, then, suffice as a explanation for life. Rather, life itself appears geared to amplifying structural information as a routine habit of living in the present. The mystery deepens.

Indeed, I am beginning to believe now that the conundrum of the amplification of biological information appears to be an artifact of human communication! The inductive logic of mathematical, physical and informational theories has contributed enormously to human weal. After all, many natural processes can be linearly approximated as mechanical processes, and the human capacity to use generalized inductive logic to construct machines has influenced human development strongly. Likewise, the symbol system of modern mathematics, grounded in the grammar of predicate logic (DeMorgan, Boole, Russell) has become an essential feature of human economic communication.

Thus, two related questions emerge. Why does the quantitative inductive logic of the modern predicate logic fail as a reference system for the amplification of chemical information following mutation and for biological communication?² And if not predicate logic and category theory, then what is the logic of amplification?

The latter question has led to a long and fruitful study of the ostension of signs as vehicles of human communication cycles – that is, the learned human cultural capacity to express our mental activities as signs and the possibility of another human to be impressed with a message similar to the original intent. The cycles of expressions and impressions as vehicles of human communication are not based on inductive generalizations of predicate logic, but rather they are induced by the particular habits of human learning.

² This question was discussed at length in my 2009 paper ‘Algebraic biology’.

Human sign systems, with the earliest records dating to the Mesopotamians in the fourth millennium BC, have proliferated in recent centuries. In particular, at the beginning of the 19th century, John Dalton introduced an iconic and indexical symbol system for the discussion and examination of individual (but invisible and indivisible) gases. Dalton's grammar was iconic with respect to the visualization of quantitative relationships – but the concept of 'relation' in chemistry was not encumbered by the grammar of predication, or by the temporality of dynamic changes of place. Rather, the simple structural notation of Dalton was based on the notion that a sign from an existent sample of a singular chemical elements was representable as a symbol for that chemical element. If two different elemental signs were emitted by a singular invisible gas, then both elemental symbols were logically necessary in order to represent the gas. Thus was born the logical foundations of the chemical sciences.

Charles Sanders Peirce (1839–1914) generalized the Daltonian notion of relation, without invoking the predicate logic of Boole and De Morgan, and also without making reference to a specific external sign. Peirce used the terminology of Firstness and Secondness as mental objects and Thirdness as the concept of relation. Moseley (1914) proposed the concept of "atomic number" as a correspondence relation between physical measurements and the listing of the chemical elements by weight. Linus Pauling (1931) attempted to formalize the relation between atomic structure and molecular structure.

In summary, the quantitative calculations of molecular formula and molecular weight and valence do not depend on the predication associated with Aristotelian efficient causality. Rather, the logical linkage is expressed in terms of Stoic logic – antecedents and consequences. The verbs linking atoms to atoms are copula, not predicate. A particular induction, not a generalized induction, is necessary to specify the conjunctive relations between any two atoms, that is, single, double, triple, aromatic, etc. bonds. Thus, the reference system for molecular biological calculations is inferred directly from the signs from material objects, not the grammar of rhetorical language usage.³

³ Some of these arguments are present in Chandler 2009b.

Substantial work remains to be done on establishing other symbolic reference systems for biology and medicine. Effective human communication requires, minimally, that the symbols used in the expression-impression cycles of human relations be mutually understood. But effective scientific communication further requires that the symbols represent signs in such a way so as not to be misunderstood. At present, ambiguity in the interdisciplinary communications among individual scientists is simply intolerable. My current view is that the logic of life is the inverse of the logic of physics is supported by semiotic reasoning. But we desperately need better methods to communicate the facts of biosemiosis to both the mathematical-physical scientists as well as to the biomedical scientists.

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PROOF

CAUSALITY

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*What I have suggested we call semiotic causality, i.e., bringing about things under guidance of interpretation in a local context.*¹

In the passage above, Jesper Hoffmeyer reconfirms the Peircean thesis that the determination of *final causation* lies at the root of everything possible in this world – yet this is the sort of remark that has long been stored deep inside the sealed Pandora’s box of the Western tradition of empirical and analytical thinking. Likewise, Sebeok’s motto that both semiosis and the phenomenon of life are coextensive, though synthetically plausible, remains not analytical enough for most mainstream scientists. The relevant question raised at this point is whether or not Hoffmeyer’s reminder above should still be seen as a red herring in science. That is what this contribution will set out to explore.

The action of a sign refers to the activity of something to the extent that it is standing in relation to something other than itself. Yet this relational activity is not an invention unique to semiotics. Rather, it is ubiquitous in the material world. Consider, for instance, the Boyle-Charles law of the ideal gas $PV=RT$ framed in the scheme of thermodynamics – in which P is the pressure of the gas, V is the volume, T is the temperature, and R is the gas constant. The gas law is under-complete in the sense that the law by itself cannot determine the value of each of the three variables in a definitive manner. Instead, the determination of the values of these variables proceeds only indirectly: The pressure P of a local region of the gas

¹ Hoffmeyer, Jesper 2008. *Biosemiotics: An Examination into the Signs of Life and the Life of Signs*. Scranton: University of Scranton Press, p. 64.

can be determinable from the law *only if* the local region can *identify* both its volume and the temperature *internally* (Matsuno 1989). The gas law is thus relational with respect to the determination of each value of the three variables.

Implicit in the relational characteristic latent in the gas law is the capacity of measurement internal to the gas itself. Although the physicist can measure each value of the three variables externally with use of an apparatus designed specifically for the purpose, thermodynamics takes the material and natural capacity of relating one variable to the remaining two other variables for granted. The *aboutness* of something in relation to something else which semiotics legitimately recognizes is already implicit in thermodynamics.

Another case of the relational characteristic revealed in the physical world is through Hugh Everett's reformulation of quantum mechanics in terms of relative-state interpretation (Everett 1957). No one can dismiss the quantum-mechanical underpinning of the material world, and semioticians are no exception. Thus, a serious question arises with regard to how one can vindicate the relational stance in quantum mechanics. The relational stance requires *the agency of internal measurement*, as demonstrated in thermodynamics. In other words, quantum mechanics would have to be at home with the act of measurement from the outset. What Everett notices in this regard is that any quantum state is relative to any other quantum state, and that the occurrence of a relative state is nothing other than the act of measurement proceeding internally (Matsuno 1989). This relative-state interpretation is certainly in conformity with the Copenhagen interpretation as championed by Niels Bohr (1949), as far as the actual experiments to be done in the laboratory are concerned. The idea of the probability amplitude of the wave function, thanks to Max Born (1949), applies to both equally. However, the difference between the two would become most acute and serious, once one comes to address the *origin* of the measurement apparatus. For while the Copenhagen interpretation takes it for granted that the physicist is responsible for preparing the measurement apparatus, the relative-state interpretation conceives of the occurrence of any quantum state relative to any other to *be* a measurement (Wheeler 1957).

One undeniable advantage of the relative-state interpretation is a total naturalization of the act of relating something to something

else. The action of a sign is certainly a demonstrative instance of the act of relating something to something else. Nonetheless, there still remains a hard issue of how to vindicate the relational stance without *relying* upon a relational stance – otherwise the relative-state interpretation would be entrapped by helpless infinite regression. In other words, it would be tolerable to say “You are relative to me”. But, if this tolerable statement is further accompanied by another one as saying “Don’t ask me to whom I am relative”, the relative-state interpretation would come to be undermined in the end.

In order to circumvent the likely stalemate, we would be asked to pay serious attention to such an exchange as “I am relative to you, but you are also relative to me” – and this has been a common symptom of the malaise suffered from the vice of self-reference. One likely first-aid for its rescue, however, would be the reappraisal of the notion of *final causality* that Hoffmeyer calls our attention to – for what is needed is a way to appraise the relational stance without invoking another relational stance.

“Final causality” has earned a bad name because of a misplaced emphasis made by both its proponents and its detractors so far. Yet final causality obtains its legitimacy in the act of preserving the class identity of each participating material element, while remaining indifferent to preserving each individual identity of the element. Thus, although the atomic physicist can detect the individual identity of each carbon atom, the biological cell keeps recognizing the class identity of each participating carbon atom even if it is replaced by another atom of the similar kind. Preserving such ‘class identity’ serves as a *final cause* directed toward the participating individual atoms and molecules though it is not tenable to observe the act of final cause as preserving the *individual* identity of the participating elementary body, because of the involvement of self-referential complications. A typical example demonstrating such class identity is the preservation of the material support that processes constant material exchanges.

In fact, a most primitive material support processing the exchange of materials is a meta-stable product – repeating its synthesis and partial decomposition, while eliminating the case of its total decomposition. Furthermore, the occurrence of those meta-stable products is experimentally demonstrative, even if the synthetic notion of life, whatever it may be, is not yet currently available.

Once such meta-stable product has been set in motion, the participation of final causality would have become a natural course of events – just as Jesper Hoffmeyer has so aptly recognized.

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PROOF

CHANCE

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Louis Pasteur has been credited for coining the saying that ‘chance favors only the prepared mind’. In essence, this captures the idea being expressed here. Chance mutations are not selected because they are beneficial; they are beneficial because they happen to appear in a relational system, which was already well prepared for them. That blind selection should be the sole cause of evolution is one of the mightiest fictions of our times. Selection is never blind; it is always guided by prior formation of development and semiotic integration.¹

We might never have come up with a concept of chance if we hadn't noticed that sometimes the outcomes of chance aren't "fair". If every sample of uncorrelated events had a nice random distribution, then there would be no patterns to get our attention. We wouldn't wonder if, or how, chance "caused" that streak of heads in a coin toss, or that fortuitous meeting at the crossroads.

Ever since Laplace, we have understood that, in the absence of complete knowledge of material causes, we may guess at the probability of certain events occurring. Events are "caused by chance" – but not in the sense of *by* a causal force or agent, but instead in the sense that events are coincidences that are either likely or unlikely...or somewhere in between. Chance, then, causes everything – even though chance *per se* is not a cause at all. We might conclude, therefore, that *chance*, as a concept, is meaningless or, at the very least, confusing. Or maybe, even after millennia of debate (the start of which probably predates Epicurus' *clinamen*), the meaning of *chance* still waits to be fully fleshed out.

¹ Hoffmeyer, Jesper 2008. *Biosemiotics: An Examination into the Signs of Life and the Life of Signs*. Scranton: University of Scranton Press, p. 202.

In the quote above, which occurs in a discussion of genetic assimilation, Jesper Hoffmeyer defines chance as relational and part of semiotic processes. Following Peirce's creation by differentiation idea in "Design and Chance" (1992: 215–224) and/or Bateson's, "difference that makes a difference" (1972: 448–466), Hoffmeyer suggests that sometimes the dice of chance are loaded. Semiosis is the cause of this "unfair" chance. Wherever a new coincidental regularity appears, it may come to function in a meaningful way to an organic system.

With this idea in mind, let's consider Pasteur's maxim more closely. The most prepared mind, to a biosemiotician, has the most *semiotic freedom*. Likewise, the most prepared cell has acquired, in its evolutionary past, a number of partial models of its environment (for example, lock-like receptors for keyed stuff it needs). We say that "chance favors" such a system – i.e., *allows it to survive and reproduce* – inasmuch as the greater number of ways of interacting increases the odds of success. But this is just 'chance' in a probabilistic sense. In the passage above, Hoffmeyer is more interested in another sense of *chance*. For him, chance doesn't just *favor* the semiotic system after the fact of its existence: chance somehow *is* semiosis – and *beneficial* chance doesn't exist except in relation to a semiotic system. Thus, when we say "chance favors" a semiotic system we mean: *allows that system to adapt*. And so how does a system discover new models; how does it learn?

Although mutations (e.g., changes of any holon: gene, protein, cell, organ, *etc.*) may be random, this does not mean that every form is tried with equal probability. Mutations are said to be 'random' only with respect to the needs of the organism. They are generally physically *similar to* and/or *contiguous with* the original configurations. Yet biosemioticians might agree that such relationships can tend, *in and of themselves*, to speak to the needs of organisms. If mutations usually result not in some random mix-up, but in a patterned group whose differences might interact and feedback, then some new type of regulatory switch might be produced and become useful to the organism in dealing with its environment. Think of Lovelock's Daisyworld whose black and white daisies create stable temperatures. New organizational systems emerge *prior to* natural selection – which only helps them by clearing the field of less prepared competitors.

Now let's look at Hoffmeyer's illustration of the role that semiotic chance plays in changes in the metabolic cycle of bacteria. When bacteria are starved of glucose, cAMP happens to accumulate and causes the cells to produce an enzyme that can metabolize lactose instead. Hoffmeyer notes that "since the shape of the cAMP molecule has many traits in common with the shape of the ATP molecule [which is necessary to metabolize glucose] [...] cAMP might easily bind to a range of enzymes at the exact same positions where ATP would normally bind" (2008: 217). He goes on to observe the semiotic nature of the interaction insofar as "cAMP in bacteria [...] may function as an *icon* for ATP (i.e., as a specific conformation that enzymes may take to be ATP)" (*ibid.*). Note that cAMP first appears here as a *side-effect* of other processes – a side-effect that is irrelevant to the needs of the bacteria. Yet its similarity in shape to ATP relates to the normal metabolic process in an effective, if different, way. Chance similarities lead to useful regularities – and to the 'preparedness' of the bacteria that can switch to an alternate resource in times of scarcity.

With this adaptation, bacteria have used something like artistic genius, stumbling upon a solution. Selection is *guided*, but there is no intelligent designer here, no engineer with well a thought-out plan. This is *spontaneous semiosis*, unconscious of course, but which enables purposeful actions.

In the past twenty years or so, the number of complexity scientists naturalizing the concept of *teleology* as self-organization has grown. Some have recognized that semiotics is needed to explain how self-organization occurs, and a few have recognized the role that 'chance' plays in semiotics: any mutation can function as an accidental icon or index, and biological systems interpret every part of themselves and the resources flowing through them. Moreover, anything that is similar to a sign used previously can be read as such – and anything that happens to be contiguous with a process can reveal something significant about that process.

Chance, it turns out, is at the heart of semiotics, self-organization and teleology. And to think that in his *Physics* (Bk II §5), Aristotle notes that some people naïvely confuse "chance" – in the sense of unfairly good coincidence – with final cause! I consider this one of the greatest philosophical near-misses in all of human

history. Coming to the question of chance and purpose with a prepared mind, Hoffmeyer is able to see the truer answer.

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PROOF

CODE-DUALITY

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*For it is the nature of the code to point outside of its own mode of existence – from the continuous to the discontinuous message, from the physical and therefore law bound message to the more free message. And back again in an unending chain.*¹

It is not an easy task to pick one single idea or quote from Jesper Hoffmeyer in order to convey how much his writings have inspired, me and to convey my gratitude for his endless generosity – especially for a person who, like me, that had the privilege of being one of his Ph.D. students.

I first “discovered” Jesper Hoffmeyer when I was searching to find out who in the academic world was carrying Gregory Bateson’s innovative epistemology further forward in the biological disciplines, and at the same time, who was maintaining an eye on the upholding the importance of ecological history. Jesper Hoffmeyer, I soon found, certainly did not stop at merely perpetuating Bateson’s revolutionary insights. Rather, he has been able to incorporate Bateson’s coherent approach to information, hierarchical contexts and analog/digital communication into a new, semiotically sound epistemology that is useful for biology and the life sciences. In a very elegant and compact manner, his notion of code-duality exemplifies this operation.

Hoffmeyer started to think in terms of code-duality around 1987, and together with Claus Emmeche published, in 1991, the seminal article ‘Code-duality and the semiotics of nature’. There they argued that code-duality is definable as the ability of a system to represent

¹ Hoffmeyer, Jesper 2002. Code duality revisited. *SEED* 2(1): 98–117 (p. 99).

itself in two different codes, one digital – a code for memory – and one analog – a code for action. Life exhibits the semiotic interaction between the two states: i.e., the analog coded state of the organism itself and its re-description in the digital code of DNA (Hoffmeyer, Emmeche 1991). We could say that in their formulation, Hoffmeyer and Emmeche have set the ‘boundaries’ for code-duality as resting between the DNA-digital code and the organismic analog code.

But what happens in between these boundaries? Inspired by this question, it appeared clear to me that the next step was to ‘unpack’ the details of the semiotic processes that comprise the ontogenetic historical continuum, and that oscillates within these boundaries of the code-dual nature of organisms and ecosystems. How does the digital become analogical, and how does the analogical goes back to digital? Is the code-dual nature of digital-analogical information also present at different integration levels of the developmental continuum?

With this in mind – and in light of current knowledge about genome architectures, cellular signaling networks, and regulatory systems – I worked on the idea of a dialectic process that could characterize the unfolding of hierarchical layers of coding and decoding based on the interplay of the digital and analogical modes of communication that mediate the integration of information in heterarchic triadic networks of causality. To continue in the Bateson-Hoffmeyer-Emmeche direction I coined the term “digital-analogical consensus” to describe this process, in which analogical signs emerge by the aggregation of digitally coded signs – and, in turn, in which the newly emergent analogical compound sign may constitute a ‘quasi-digital’ piece of information to a higher level of coding, constituting a higher order ‘logical product’ (Bruni 2002; 2007). In other words, *in between* the polar boundaries of code-duality, there is an endless hierarchical digital-analog dialectic that takes place across the many layers of the ontogenetic continuum.

As with any seminal concept, Hoffmeyer’s notion of code-duality also has the quality of generating many new fruitful questions, and if it is truly seminal, it will generate more questions than answers. According to Hoffmeyer, self-reference is the fundament on which life evolves, and code-duality is the central feature allowing for self-reference, which in turn depends on some kind of re-description. In living systems, this description is made in the

digital code of DNA (or RNA) – what Hoffmeyer refers to the code for memory. Yet whereas it has also been stated by Hoffmeyer that this digital memory is only part of the description, it still remains ambiguous whether the digital description of DNA conveys anything more than amino-acid sequences for successful proteins, as for example, when it is claimed that: “What should be specified through the memorized description is not the material details of the system, but only its structural relations in space and time” and that “the realization in space and time of the structural relations specified in the digital code defines what kind of differences in the surroundings the system will actually select and respond to” (Hoffmeyer 2002: 103).

These observations beg the question of how should such structural relations in space and time could become specified in the digital code. The ambiguity may lie in the fact that the necessary self-description for self-reference is always transmitted and inherited in *both* codes acting together simultaneously: therefore, the duality. In a sense, both codes are for action *and* for memory, since one cannot work without the other. According to Hoffmeyer “the fertilized egg cell [...] must be able to decipher the DNA-code [...] a sort of ‘tacit knowledge’ is present in the egg cell [...] the existence of this tacit knowledge hidden in the cellular organization must be presupposed in the DNA description” (Hoffmeyer 2002: 103).

To avoid the misinterpretation of the digital description as a being a “total” description, however, it is necessary to try to specify in which sense “the tacit knowledge hidden in the cellular organization is presupposed in the DNA description”. What is presupposed in the DNA description cannot be the knowledge itself, but the existence of elements (e.g., protein domains) which can fit into systems of correspondence that are already present as analogs, for the development of *codes* that actually deal with the myriad of differences in the surroundings that the system will encounter. Such codes, I posit, are not at all static entities, but exist in a continuous dialectic conversion of digital and analogue messages or signs. In other words: a digital ‘synchronous state’ flows in a ‘diachronic process’, becoming thus analogical. Here it is important to emphasize that what is passed from generation to generation is *the whole system of code-duality*.

This brings us back precisely to what Jesper Hoffmeyer claimed in the origin of the concept: that it was, from the beginning, linked to the idea of life as a chain of codings and recodings.

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PROOF

COHERENCE

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*Semiotic scaffolding operates by assuring performance through semiotic interaction with cue elements that are characteristically present in dynamic situations.*¹

It was Jesper Hoffmeyer who introduced me to the concept of semiotic scaffolding. As matters developed, this notion became highly instrumental in resolving a difficulty I was having with my own narrative of ecological dynamics.

In my description of ecosystem behavior, the dynamics of autocatalysis, or indirect mutualism, is central to the creation of enduring configurations of processes and their attendant structures (Ulanowicz 1997). Causal loops of material transfers abound in ecosystems, but the problem with such feedbacks is that the time of mass transit around these cycles was often quite long – on the order of days to months. Far too much time elapses between an action and its reward to reinforce a behavior effectively.

As I wrestled with the problem, several physicist colleagues introduced me to the phenomenon of ‘coherence domains’ in condensed matter physics. For example, an aggregation of water molecules is able to maintain its identity as a coherent group, because simultaneity is keyed by the very rapid propagation of information at the speed of the phase velocity in the quantum vacuum, which is very fast in comparison to the propagation of columbic forces

¹ Hoffmeyer, Jesper 2007. Semiotic scaffolding of living systems. In: Barbieri, Marcello (ed.), *Introduction to Biosemiotics: The New Biological Synthesis*. Dordrecht: Springer, 149–166 (p. 154).

(Brizhik *et al.* 2009). I have my doubts whether the quantum vacuum is relevant at the scale of an ecosystem, but the picture of the order of ecosystem processes being maintained by the rapid transmission of information certainly seemed plausible.

Of course, the prime candidate for rapid communication is semiosis, which can occur virtually at the speed of light in many cases. It also stood to reason that signs could be objects of autocatalytic selection within the ecosystem. Whence, circuits of resource feedbacks could progressively become supported by a scaffolding of semiotic signals. Rewards could propagate around the autocatalytic loop much faster than the actual exchange of material. The elements of semiotic scaffolding could thereby become locked into the role of anticipatory controls in the sense of Robert Rosen (1985).

In conclusion, Jesper's work on semiotic scaffolding, in conjunction with my own on indirect mutualisms, provides a very plausible scenario for the maintenance of order in ecosystems.

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COMPLEXIFICATION

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*The semiotic dimension of a system is always grounded in the organization of its constituent material components, and cannot exist without this grounding, but evolution has tended to create more and more sophisticated semiotic interactions which were less and less constrained by the laws of the material world from which they were ultimately derived.*¹

There is virtually a consensus that complexity has increased in information living systems, giving rise to symbolicity, grammar, syntactic recursiveness, etc. However, the processes behind the complexification of semiosis and its relation to evolution are not well understood. Moreover, the evolution of ‘semiotic complexity’ can mean different things in different domains.

Concretely, many open questions can be asked: What is semiotic complexity? How can semiotic complexity growth be measured in natural living systems? What are the main hypotheses about semiotic complexity growth that can actually be tested? Are the principles of natural selection sufficient to explain the evolution of semiotic complexity in biological systems? How do semiotic systems emerge from reactive systems? How do high level processes (e.g., symbol-based communication) emerge from lower-level processes (e.g., indexical)?

Jesper Hoffmeyer has proposed a conceptual criterion to describe the evolutionary tendency of semiotic complexification related to the material basis (perhaps including formal and structural organi-

¹ Hoffmeyer, Jesper 2006. Semiosis and living membranes. In: Farias, Priscila; Queiroz, João (eds.), *Advanced Issues on Cognitive Science and Semiotics*. Maastricht: Shaker, 19–35 (p. 21).

zation) of semiotic systems and processes. According to Hoffmeyer: “our universe has a built-in tendency to produce organized systems possessing increasingly more semiotic freedom in the case that the semiotic aspect of the system’s activity becomes more and more autonomous, relative to its material basis” (2006: 20).

This definition is very consistent with Peircean classification of fundamental semiotic processes. In cognitive ethology and zoo-semiotics, several authors have suggested that a transition towards a complex semiotic process involves the audience modulation of the sign (see Pollick *et al.* 2005). This is also very much congruent with Peirce’s semiotic typology. Peirce’s fundamental typology exhibits a property capable of functioning as a conceptual (and ‘operational’) criterion to distinguish different kinds of signs: the relative dependence of sign–object–interpretant (S–O–I) components in triadic relation.

A symbol is a S–O relationship logically dependent of I. A symbol is “a Sign (*q.v.*) which is constituted a sign merely or mainly by the fact that it is used and understood as such, whether the habit is natural or conventional, and without regard to the motives which originally governed its selection” (CP 2.307). In a different way, an index is dependent of O. Constraints resulting from the space-time existence of the object represented by the index are irrelevant in symbolic processes. Icons, in turn, are deeply dependent on the material, form and structure that they are made of – “an *Icon* is a sign which refers to the Object that it denotes merely by virtue of characters of its own, and which it possesses, just the same, whether any such Object actually exists or not” (CP 2.247).

If semiosis exhibits a rich variety of morphological patterns, an interesting question is how the classification of this variety can provide a (conceptual and operational) criterion to distinguish different levels of semiotic complexity. In several papers, I have argued – *against* the idea that symbols are uniquely human – that alarm-calls such as those used by African vervet monkeys (*Cerco-pithecus aethiops*) satisfy Peirce’s formal definition of symbols (see Queiroz, in press; Ribeiro *et al.* 2007; Queiroz, Ribeiro 2002).

I have, moreover, suggested that a specific interpretative behavior indicates the emergence of symbols. The transition from a sensory scan behavior after the auditory perception alarm to an escape reaction motivated solely by the call corresponds to the transition

from indexical to symbolic semiosis. The object of the sign, in the latter case, is not an object but a class of objects, and therefore does not need to exist as a singular event. If there is a threshold index > symbol, then it should be possible to identify the behavioral transition from “object that is an event” to “object that is a class of events” – i.e., an object that does not need to be present as an external particular object. For Peirce, “a symbol cannot indicate any particular thing; it denotes a kind of thing” (CP 2.301).

The relevance of this topic is indisputable. The *transition* to symbol-based semiosis is a central theme for the evolution of language research, biosemiotics and philosophy of biology. A system which is capable of interpretation through symbols evolves in a manner which is determined by the fact that by using law-like regularities they are capable of obtaining and transmitting information about the environment. But the processes behind the emergence of symbolic processes and its relation to evolution are not well understood. In my opinion, it is very quickly accepted that semiotic complexification is, following a logic of subsumption hierarchy, a ‘refinement’ of previously established processes (cf. Harnard, Deacon, Tomasello, and others). It is assumed that after the emergence of semiotic systems, it is possible that iconic, indexical, and symbolic systems appeared in a specific sequence.

But, if it is difficult to ascertain which process came before others, it is even harder to determine whether a precursor should be viewed as a prerequisite. Even though Peirce had established a rigorous distinction between different classes of sign processes as well as between semiotic behavior and brute reactive behavior, he did not describe the following: the dynamics responsible for the emergence of semiosis in an evolutionary scenario, the dynamics responsible for the transition from iconic and indexical semiotic systems to symbolic and meta-semiotic ones. Hoffmeyer’s proposal must be considered the first attempt to establish a criterion to consistently relate evolution and semiotic complexity.

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PROOF

CONNECTIONS

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*How did Nature come to mean something to someone?*¹

Jesper Hoffmeyer's innovative concept of a *biological semiosphere* has significant connections with at least one basic concept in biology and with several basic concepts and writings in other disciplines. In what follows, I give a brief indication of a foundational aspect of 'meaning', and then briefly itemize seven concepts that connect in seminal ways with Hoffmeyer's innovative concept. These significant connections incidentally show that Hoffmeyer's concept need not rely only on a Peircean semiotic grid for its epistemological significance or theoretical validity.

Meaning, at all levels of life, is articulated in an intercorporeal dynamic – whether the bodies involved are molecular or cellular, or whether they are the interactive full-bodied bodies of ants, zebras, or humans, or the relational dynamics of such bodies to object bodies encountered in a surrounding world (e.g., stones, leaves, berries, twigs, puddles, swamps, dirt mounds, or simply the tactilely-felt ground of earth itself). Whatever the intercorporeal dynamics, they define in broad terms a relationship that is grounded foundationally in animation and in the dynamic interconnectedness of all aspects and forms of life.

(1) The basic concept in biology that has significant connections with Hoffmeyer's semiosphere is that of *responsivity*. In her well-known textbook *Biology*, Helena Curtis specifies *responsivity* as one of eight crucial aspects of life: "*Living things respond to stimuli*."

¹ Hoffmeyer, Jesper 1996. *Signs of Meaning in the Universe*. (Haveland, H. J., trans.) Bloomington: Indiana University Press (p. viii).

Plant seedlings bend toward light; mealworms congregate in dampness; cats pound on small moving objects; even certain bacteria move toward or away from particular chemicals" (Curtis 1975: 28; see also Keeton, Gould 1986: 195, on the "energetic basis of life"). Clearly, forms of life find meaning in their surrounding world and those meanings are kinetically articulated in their moving bodies. As Hoffmeyer writes, "the body interprets our *umwelt* while generating a constant stream of consciousness" (1996: 120). We could equally say "[...] while generating a constant stream of movement or stillness". In other words, animate forms of life respond to their surrounding world, moving – or not moving – meaningfully within it.

(2) Charles Darwin gives a striking example of the dynamic interconnectedness of forms of life when he describes in detail the effect of the introduction of Scotch firs on a diversity of insects, birds, and even cattle. He is indeed at pains to emphasize "how plants and animals, most remote in the scale of nature, are bound together by a web of complex relations" (Darwin 1968: 124–125). To be so bound is descriptively akin to what Hoffmeyer describes as "our swarming body-brain" (1996: 122). In each instance, "a web of complex relations" is evident: at all levels of life, a dynamic interconnectedness obtains.

(3) In his experimental and clinical studies of the neuromuscular system in relation to the brain, neuropsychiatrist Edmund Jacobson specifies the dynamic interconnectedness of living bodies in terms of "an effort-brain circuit". He shows why "Those who would do homage to the brain with its ten billion cell-amplifiers can well continue to do so", but why they must also not overlook empirical evidence, namely, that "muscles and brain proceed together in one effort-circuit, active or relaxed" (Jacobson 1967: 36, 34, respectively). Jacobson's "circuit" is conceptually akin to what Hoffmeyer identifies as "the semiotic brain-body system as a whole" (1996: 121).

(4) Socrates implicitly emphasizes the importance of recognizing the interconnectedness of life in the pursuit of knowledge when he admonishes those so interested to heed the importance of carving at the proper joints, and "not breaking any part as a bad carver might" (*Phaedrus* 265 E). Socrates's injunction accords in strategic methodological ways with Hoffmeyer's emphasis on "complex systems" (Hoffmeyer 1996: 26), on "communication systems between

elements" (1996: 73), and on the recognition of "self-organizing chaos" as the *modus operandi* of living forms (1996: 94). Their emphasis is of particular moment in light of today's near disembodied attention on *the brain*.

(5) In his study of "the appearance of animals", biologist Adolf Portmann describes and exemplifies "inwardness" (Portmann 1967: 183–201). He aptly pinpoints the dynamic interconnectedness of the outward behavior of animals with their inner life of feelings and awarenesses. Hoffmeyer's concerns with "how the body can become 'minded' and how the mind can become physical" (Hoffmeyer 1996: 69), and how "it is not the brain that does the thinking in a human being, it is not even the body, but the natural history whose children we all are and in which we all have a part to play" (1996: 95) conceptually parallels Portmann's descriptions and exemplifications.

(6) J. A. Scott Kelso's extensive investigations of *coordination dynamics* in both neurological and behavioral terms, and his recognition of an intrinsic dynamics in the first place, are in conceptual line with Hoffmeyer's recognition of "the coordinative puzzle that every living creature is charged with solving every single second of its life" (Hoffmeyer 1996: 73). Kelso writes: "It is important to keep in mind...that the brain did not evolve merely to register representations of the world; rather, it evolved for adaptive action and behavior. Musculoskeletal structures coevolved with appropriate brain structures so that the entire unit functions together" (Kelso 1995: 268). He adds that G. Edelman arrived at a similar conclusion: "For him, like me it is the entire system of muscles, joints, and proprioceptive and kinesthetic functions plus appropriate parts of the brain that evolves and functions together in a unitary way" (*ibid*).

(7) My own work has focused on the dynamic interconnectedness of life in terms of our common creaturehood and common humanity, and on primal animation and an evolutionary semantics, both of which attest to a readiness toward meaning that is at the focal point of any creature's survival (Sheets-Johnstone 2011 [1999]).

Hoffmeyer's rich concept of a *biological semiosphere* ties in not only with our common creaturehood and readiness toward meaning, but has itself significant connections to a range of studies by other researchers as shown above. That richness and those connections

extend well beyond the bounds of a strictly Peircean metaphysics of signs.

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CONSCIOUSNESS

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*I would suggest therefore that we look upon consciousness as a purely semiotic relation: consciousness is the body's spatial and narrative interpretation of its existential Umwelt.*¹

What does Jesper Hoffmeyer mean by his use of the body as the physical interpreter of a series of discontinuous content events, such that this interpretation is called 'consciousness'? I suspect I have never quite understood this suggestion, as it seems to me that doing so makes the body into a boundary between the individual (with its varied swarm intelligences) and an *Umwelt* that is somehow exterior to that body. However, 'consciousness' is a strange kind of emergent phenomenon. For we are more conscious, more aware, of events *external* to our bodies than we are aware of events internal to them. For instance, I can consciously discern the color of a passing car, but I cannot so consciously discern the meaning of a stomach pain. In fact, to find out the meaning, the interpretation, of a stomach pain, I have to go to a specially trained semiotician: namely, a physician.

Evolutionarily, we can say that events external to the individual were perhaps more important to that individual's survival (and the passing on of his or her genes to the next generation) than internal events. But at what point in evolution was that dichotomy established? For a prokaryote, the external and the internal seemingly have the same valence or significance. In this case, we can legitimately say that the cell wall of a bacterium serves as a boundary –

¹ Hoffmeyer, Jesper 1996. *Signs of Meaning in the Universe*, Trans. Barbara J. Haveland, Bloomington: Indiana University Press, p. 122.

as a “not” statement – since it divides the world into two domains: i.e., bacterium and not-bacterium. But the importance of this distinction is minimal, since the cell wall does not serve to shield the genetic material of the prokaryote from being altered in the way that the body (or analog code) does in a eukaryote. Somewhere along the evolutionary pathway, it became important (or was selectively advantageous) to shield the genetic material so that information could be passed on to the next generation in a relatively unscathed form.

Could this change have been the start of some kind of ‘consciousness’ – or, at least, awareness? (‘Consciousness’ is a difficult word to use, since it is predisposed to be viewed in a human, or at least an anthropological, way). For with the arrival of the eukaryote comes the nucleus – the first internal moment of alienation. For now not only is there a not-amoebe domain on the outside (i.e., the environment), but there is also a kind of not-amoebe domain on the inside (i.e., the nucleus). Another way of looking at this is to see the relationship between the environment and the genetic material in a prokaryote as being a kind of stimulus-response relationship – wherein the hyphen represents the journey that the stimulus has to travel through the cell wall and the cytoplasm, before it reaches the genetic material. Thus, the relationship of environment to genetic material in a prokaryote bears a striking resemblance to a dyadic relationship. Or, at the very least, it resembles the linear progression:

Stimulus → cell membrane + cytoplasm → genetic material

In a eukaryote, on the other hand, there is an object that prevents the stimulus from directly reaching the genetic material: namely, the nuclear membrane. This object – this hindrance – is an instance of the “brute fact” of Secondness as described by C. S. Peirce (1997: §376). Thus, with the introduction of Secondness at the mere level of the eukaryotic cell, we have the beginnings of triadicity. This Secondness reflects what Hoffmeyer refers to as *alienation* for prokaryotic genetic material is not truly alienated from its environment the way that eukaryotic genetic material is.

And what has this to do with ‘consciousness’, you ask? Consider the prokaryote-eukaryote example as an analogy to the ways in which non-human animals versus human animals relate among

themselves. Following Hoffmeyer, I posit that the great difference between the human and the non-human animal is the presence of language among human animals. It is easy to see language as a unifier among humans, but it just as often functions as a barrier. It is a “brute fact” such that language functions as a mediator between humans. We do not communicate directly with one another. There is no chemical immediacy. We communicate through a Second, through language.

But does this aspect of the “existential *umwelt*” really lend itself to being interpreted solely through the body? While I agree that consciousness is some kind of “semiotic relation”, I think there is more going on than what is delimited by the body – although I heartily agree that the limitations (or boundaries) of the body are probably what give us a sense of ego reality. But how is it that the body is involved in interpreting another interpreting body? And why have the medium of language? I would like to posit an alternative to Hoffmeyer’s analysis in the quote above. I believe we are also interpreted by other bodies – and as humans, unlike animals, this information comes to us through the medium of language. Thus, we meet not only the Secondness of the Other; we also meet the Secondness of the Other’s language.

Language is also the medium by which we tell our narratives to ourselves. In this way, language also functions as an internal Secondness, analogous to the nuclear membrane. Thus, a narrative view of consciousness precludes direct knowledge of ourselves. For example, we have no narrative about the state of our stomach; we simply and directly feel the pain. The person who has the general narrative about the stomach is the physician. Therefore, my argument would be that it is the language – and *thus* the consciousness – of others that makes us who we are, and that gives us our consciousness.

Our bodies separate us from the environment just like a prokaryote’s cell wall separates it from its environment. And language separates us from our fellow humans; it prevents us from accessing each other directly. It functions analogously to the nuclear membrane, and it introduces the element of Secondness, and thus triadicity, into human relationships. Yes, ‘consciousness’ is a “semiotic relation”, but where the fundamental nature of human consciousness is concerned, it is not a semiotic relationship within

the human body. Rather, it is a semiotic relationship *between* human beings. Thus, we can amplify upon Hoffmeyer's notion that consciousness "is the body's spatial and narrative interpretation of its existential umwelt" by saying that consciousness is also results from the interaction between and among different narrative interpretations from different umwelten.

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CONTROL

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*The [...] technological principle behind the present cultural transformation is [...] controlled semiosis [...]. What is new is that we now [...] have also learned how to implement [...] signification in the world of machines and media. For [...] the most pronounced feature of the new technologies is not just their capacity for the mechanization of information processing but their usefulness as tools for semiotic activity of every sort. [...] The kind of society we are now entering appears to be one that will derive its enabling power [...] from the ability to produce the technological means for ever more sophisticated command over the semiotic dimension over the natural world. [...] What we are now facing [...] is the setting free [...] of the semiotic dimension from its bindings in organic life. This is what I have called the development of biosemiotic technologies.*¹

Jesper Hoffmeyer is undoubtedly a classic scholar of semiotics. His masterpieces *Signs of Meaning in the Universe* (1996) and *Bio-semiotics: An Examination into the Signs of Life and the Life of Signs* (2008), belong to the bedrock of contemporary biosemiotics, an area of research in which Sebeok and Hoffmeyer have been my main sources of information and inspiration since 1990, when we first met at the occasion of one of the legendary Glottortal Colloquia. Specifically, Hoffmeyer deserves a place of honour in the history of biosemiotics for his firm semiotic stance against a scientific milieu which, rooted in the dualistic ‘two-cultures’ paradigm, has too long insisted on separating the study of nature from the study of mind, “encouraging scientists to *de-semiotize* all the naturally communi-

¹ Hoffmeyer, Jesper 2008. *Biosemiotics: An Examination into the Signs of Life and the Life of Signs*. (Favareau, Donald, ed.) Scranton: University of Scranton Press (pp. 343–344).

cative and fundamentally interactive processes of living systems” (Hoffmeyer 2008: xiv).

Moreover, Hoffmeyer has dared to adopt Peirce’s theory of semiosis as an underpinning of research in molecular and evolutionary biology although it may be “suitable for provoking all alarm bells to ring in the mind of a modern science reader” (2008: 63). It is his merit to have introduced Peirce’s provocative ideas of final causality, semiotic growth, and the *law of mind* into contemporary biology and to have defended them as indispensable research principles against such unfounded allegations as ‘vitalism’ (2008: 8).

In the quotation that appears above, Hoffmeyer proposes an extension of evolutionary history from the origins of life to contemporary media technology. The argument is that we are facing a new era in which semiosis is set free “from its bindings in organic life”. This is certainly thought provoking but it remains somewhat isolated, as if the author were afraid of facing the implication that the predicted era might be one of *postbiological semiosis* (cf. Santaella 2003; Nöth 2008). The following considerations, developed more in depth elsewhere (e.g. Nöth 2002; 2009), attempt to pursue such implications in light of Peirce’s theory of semiosis. Lack of space requires a restriction to three related *theses on postbiological semiosis*, whose presentation must remain very sketchy.

Thesis 1: Semiosis has a dynamics irreducible to biology or psychology. Although signs need an organism to become efficient and to live on, their agency cannot be reduced to the efficient causality of specific biological and mental processes. A sign operates by *final causality*, and its reality is one of *virtual reality*. Even thoughts, or mental representations, are signs, according to Peirce, but to consider their semiotic essence it is necessary “to clear the sign of its mental associations [...] since nothing but feeling is exclusively mental” (CP 5.473, ca.1906). The virtual reality of a sign consists in the continuity of its life irrespective of any particular embodiment, for:

“Before the sign was uttered, it already was virtually present to the consciousness of the utterer, in the form of thought. But [...] a thought is itself a sign, and should itself have an utterer [...] to whose consciousness it must have been already virtually present, and so back. Likewise, after a sign has been interpreted, it will virtually remain in the

consciousness of its interpreter [...] and in its turn, have an interpreter, and so on forward” (EP2: 403, 1907; emphasis added).

Thesis II: Signs are not merely the instruments of living agents, as Hoffmeyer’s scenario of our growing “command over semiotic processes” suggests, *but they have an agency of their own*. Peirce’s semiotics is not an instrumental sign theory, according to which signs serve the interest of “sign users”, however powerful they may be. Instead, a sign has also a purpose of its own, which “is that it shall be interpreted in another sign” (CP 8.191, ca. 1904). Although we need signs to think and to communicate, we are not omnipotent masters of our messages since our signs “might turn round and say: ‘You mean nothing which we have not taught you, and then only so far as you address some word as the interpretant of your thought’. In fact, therefore, men and words reciprocally educate each other” (CP 5.313, 1868). Hence:

Thesis III. Signs cannot be fully controlled since they evince a capacity for self-control, which consists in their resistance against representations ignoring “that truth and justice are the greatest powers in this world”. Although these powers need “defenders to uphold it” they are also able to create their own “defenders and gives them strength”. After all, “there is efficient causation and there is final, or ideal, causation. If either of them is to be set down as a metaphor, it is rather the former” (CP 8.272, 1897).

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CONVERSATIONS

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*When we became human beings, language ran its hyphae far into the nervous system, allowing, today, no hope of extinction – not even in theory. Language does not think through us, but has become a part of us. And yet language is common property and hence, extraneous to us. And this fact – that the spoken word is common property, that it is a tool with which to share a world – is perhaps the real reason for its emergence.*¹

Jesper Hoffmeyer, who as many of his close associates know, is a great fan of all things language related – puns, jokes, double entendres, translations, and the etymology and regional variants of words – once told us that he “follows his nose” when thinking through complex ideas, in order to find his way to the heart of where he intuits some conceptual problem lies.

A biochemist by training (and a natural philosopher by avocation, notwithstanding his protestations to the contrary), Jesper nonetheless exhibits a sophisticated understand of the nature of language in his brief rumination on the topic above. Like his role model (to the extent that Jesper can be said to have a role model!), Gregory Bateson, however, Jesper often presents his readers with such diamonds in the rough – leaving the reader to work with and develop the insights further, should he or she be so inclined.

In this brief submission, we want to consider the apparent paradox in the adjoining claims that “language does not think through us, but has become a part of us” *and* that “language is common property and hence, extraneous to us” (Hoffmeyer 1996: 112). How

¹ Hoffmeyer, Jesper 1996. *Signs of Meaning in the Universe*. (Haveland, Barbara J., trans.) Bloomington: Indiana University Press (p. 112).

can what is extraneous to us be a part of us? Has Jesper's nose led him into contradiction here – or is there a deeper logic at play that can reconcile these two seemingly contradictory ideas?

As so often is the case in Jesper's writings, the deeper logic reveals itself when one considers his biosemiotic *Weltanschauung* as a whole. For unlike many traditional linguists, who consider words and sentences as the ultimate object of their inquiry (just as many geneticists consider nucleotides and genes), Jesper sees words and sentences (as well as nucleotides and genes) as derivative manifestations of a more primary unit of analysis, which is, of course, the sign.

And the sign, as Jesper (invoking both Peirce and John Deely) reminds us, when acting as a sign, always has one foot each in of two worlds simultaneously – one in the world of mind-dependant reality and one in the world of mind-independant reality – and a third that consists entirely of the mediating relation between the two (Hoffmeyer 2008: 266–269). Thus, the apparent paradox of internalism versus externalism is resolved with this fuller understanding of the nature of the sign, of which language is just one more by-product.

Understanding this relation, though, leads us to re-examine – in a way that Jesper, already moving on, has not – the validity of the claim in the quote above that “language does not think through us” (Hoffmeyer 1996:112).

Having no independant material reality of its own, language, we want to argue, is a sign system that very much does “think” (meaning: become a site of cognitive capability) solely through the actions of the agents in the world that are communally using it as such. Rather than language running its hyphae into us, it is the interactive community of meaning-making human practice that runs the hyphae its own ever-evolving and end-directed sign use back into the nucleus (or *spitzenkörper*, to continue with Jesper's fungal analogy) of language growth and development.

In this recursive – and eminently biosemiotic – sense, language does indeed think through us, just as all sign systems in the biological world become invested with their meanings through, and only through, the actions of those agents that are using them upon the world, and the recursive effects of doing so in that world upon those agents.

It is through such semiotic recursion, writes ethnomethodologist John Heritage, “that a *known in common* world is incorrigibly assured as, simultaneously, the process, presupposition and product of the reasoning practices involved [...] It is, moreover, produced as an incorrigible product, as an objective world which could not have been otherwise [...] and] through these means, the *intersubjective availability* of real world events is produced and reproduced as the indubitably *given*, stable features of real world events which, for its producers, it has always been” (Heritage 1984: 216).

Like all signs systems, then, language, is not just “a tool to share the world”, but to create a world that issuitable for its users to live in. For humans, this world is what Jesper refers to at the end of his discussion on the evolution of language as “a mystically produced common dwelling place [...] one large common umwelt” (Hoffmeyer 1996: 112). That he has done so much to make that world so much more understandable to us is a testament to Jesper Hoffmeyer’s genius ... and, perhaps, to his nose.

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CO-RELATIONS

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Biosemiotics suggest that living systems should be studied as semiotic systems in their own right. This idea is based on the belief that the poverty of the information discourse in biological sciences results from the reductive neglect of the interpretative aspect of biological information. By introducing the concept of the sign as developed by the American chemist and philosopher Charles Peirce (1839–1914) as a substitute for information it will be assured that the interpretative side of information is not neglected.¹

Jesper Hoffmeyer summarizes here the fertility of adopting Peirce's semeiotic to understand biological phenomena in contraposition to a reductionist informational approach that grew among biologists since Shannon formulated the statistical conception of information in the late 1940s. As we know, Peirce's definition of sign is based on a non-reductive triadic and dynamic relation among something that might assume the role of a *sign* (actually, any conceivable thing), the *object* (again, any conceivable thing) that might be represented in any possible way by the sign, and an *interpretant*, which is any conceivable effect produced by the relation between sign and its object.

Note that these three elements are called *correlates* because they can be defined only in relation to one another. Nothing is a sign, an object or an interpretant *a priori*, but only as part of this very same triadic process. That's why the emphasis of semeiotic studies should

¹ Hoffmeyer, Jesper 2010. Semiotic freedom: An emerging force. In: Davies, Paul; Gregersen, Niels Henrik (eds.), *Information and the Nature of Reality: From Physics to Metaphysics*. Cambridge: Cambridge University Press, 185–204 (p. 189).

be put on semeiosis,² understood as the continuous action of the sign, involving the three mentioned correlates, to produce phenomena. Meaning is the collective result, usually a habit (either mental or a simple disposition to act accordingly), generated by the interpretant aspect of the triadic sign correlation.

As Hoffmeyer points out above, “the poverty of the information discourse in biological sciences results from the reductive neglect of the interpretative aspect of biological information.” In fact, Shannon’s mathematical theory of information leaves no room for meaning because it does not comprehend purposeful aspects of information. Nevertheless, *living* systems – as the gerund of the verb declaims – are perfect examples of semeiosis because they are interpretive-oriented in a continuous purposeful process that connects onto and phylogenesis. There are many levels of general purposes in biological semeiosis, the most basic one being systemic *permanence* of individuals pertaining to species, usually defined as metabolism (at the individual level) and reproduction (at the species level).

Hoffmeyer says that we might profit by substituting the concept of information with Peirce’s concept of sign. Actually, we might keep both if we substitute, instead, Shannon’s information with Peirce’s own definition of information. This is a fundamental step.

Few biosemioticians know that Peirce had a theory of information which, not surprisingly, is a correlate quantity of a triadic relation which includes extension (all objects that can be indicated by a sign, that is, its indexical component) and comprehension (all general predicates involved in the definition of a sign, that is, its symbolic component). An increase of information is the growth of either extension or comprehension without the diminishing of the other. Pragmatically, it can be understood both as the growth of knowledge in a community of interpreters or of adaptability of a species, as it refines its representation of its environment (i.e., its *umwelt*) through development of new general characters (the effects or interpretive responses to the signs coming from the environment). Both phenomena are semeiotically identical. That’s why Peirce

² I use Peirce’s spelling of this term here and throughout, to emphasize, with John Deely, that “Peirce’s semeiotic refers to the *action* of signs, not to the behavior of animals when using signs” (Deely 2008: 3).

explains that: “Analogous to increase of information in us, there is a phenomenon of nature – development – by which a multitude of things come to have a multitude of characters, which have been involved in few characters in few things” (CP 2.419).

Hoffmeyer goes just to the point, then, when he criticizes the statistical paradigm of information and states that “living systems should be studied as semiotic systems in their own right” (Hoffmeyer 2010: 189). Signs grow and develop in semeiosis, just as living systems do. Biology and semiotics are naturally coextensive, as Jesper Hoffmeyer has been so tirelessly and pioneeringly teaching us for the last decades.

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CULTURE

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Cultural sign processes must be regarded as special instances of a more general and extensive biosemiosis that continuously unfolds and acts in the biosphere.¹

The study of the relationship between semiosis in nature and in culture – that is, between biology and mind – is at the core of the biosemiotic movement. Understanding how the two forms of sign-making are linked started with Uexküll, moved through the Tartu School, and ended up on the research agenda of current biosemioticians, among whom Jesper Hoffmeyer stands out as an influential leader.

In his works, Hoffmeyer sees a synergy between the various forms of semiosis, suggesting that culture and biology are intrinsically intertwined in a kind of “dance of life,” figuratively speaking. As he has cogently argued, the semiosphere, like the biosphere, regulates human behavior and shapes evolution. The former demonstrates intentionality, however, while the latter does not. Thus, although humans can do little about their biological paradigm, they have the ability to reshape their worlds any time they want. They are “world-makers”.

Cultures are thus both restrictive and liberating. They are restrictive because they impose upon individuals born into them an already-fixed system of signification, and thereby condition how people come to understand the world around them – in terms of the language, music, myths, rituals, technological systems, and other

¹ Hoffmeyer, Jesper 2008. *Biosemiotics: An Examination into the Signs of Life and the Life of Signs*. Scranton: University of Scranton Press, p. 4.

codes that they learn in context. But cultures are also liberating because they allow for the same codes to be used creatively. The artistic, religious, scientific, and philosophical texts to which individuals are exposed in social contexts, moreover, open up the mind, stimulate creativity, and engender freedom of thought.

As a result, human beings tend to become restless for new meanings, new inventions. For this reason, the codes of mind, unlike the codes of nature, provide humans with the possibility of literally changing the world, as do new generations of artists, scientists, philosophers, and others, and to meet new demands, new ideas, and new challenges. As the work on autopoiesis within biosemiotics is starting to show, this seems to be a law of human nature – and as the philosopher of science Jacob Bronowski remarked, it is the defining feature of the human, making humans unique among all species:

The images play out for us events which are not present to our senses, and thereby guard the past and create the future—a future that does not yet exist, and may never come to exist in that form. By contrast, the lack of symbolic ideas, or their rudimentary poverty, cuts off an animal from the past and the future alike, and imprisons it in the present. Of all the distinctions between man and animal, the characteristic gift which makes us human is the power to work with symbolic images (Bronowski 1977: 25).

Hoffmeyer's work has been highly influential in showing how the human mind (*Innenwelt*) stands out as a force in evolutionary processes (*Umwelt*). Like Uexküll and the late Thomas Sebeok, Hoffmeyer sees a point of contact between the mainstream scientific approach to the study of organisms – biology – and that of the strictly semiotic tradition. He has astutely argued that the study of cultural phenomena is a study of the symptomatology between body, mind, and environment. In effect, one cannot separate semiotics from biology, and vice versa.

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*A dog is a message for another dog.*¹

The above idea by Jesper Hoffmeyer has immediately attracted my attention. However, I don't wish to analyze that idea within the context of the zoosemiotics of the dog, but to reverse its perspective and to test its meaning within the context of the new technologies of cognition and information, by asking: In which way could a message be a dog for another message?

Put in such an abrupt way, the question evidently appears a little bit absurd. In this paper, I shall suggest that this is far of being the case, and that such a proposition could even open up an untrod space of research that one could call *zootechnosemiotics* – zoosemiotics within highly technologized ecosystems.²

To give sense to my above question, one has to take into account the new technologies of cognition and information, especially those of the Persistent Virtual Worlds (henceforth: PVW), of which *Second Life* still is the most well known. These exclusively digital spaces are true potential ecosystems – yet that are not subject to the usual laws of physics! They thus raise very interesting theoretical problems, some of which are of special interest for the zoosemiotician, such as: What does it mean for an agent to act and to behave in an apparently completely matterless world, where the distinction between what is living and what is not has become so

¹ Hoffmeyer, Jesper 1996. *Signs of Meaning in the Universe*. (Haveland, Barbara J., trans.) Bloomington: Indiana University Press. p. 46.

² The pioneer of technozoosemiotics could said to be the French artist Louis Bec, who described his own works in such a way.

problematic? Because, depending on how you look at it, either nothing is living there (e.g., there is no metabolism in a PVW) or, on the contrary, because everything is living there (in that everything exhibits the symptoms of life).

‘Artificial Life’ is a project that has been developing since the middle of the 80’s by pioneers such as Chris Langton (1988), and has been showing us that digital artifacts can exhibit behaviors that can be assimilated to the behaviors of living beings through self-modification, reproduction, etc. “Are these artifacts really alive?” is the question that is always being asked – but, for me, is not the most interesting one. Instead, another perspective, a more zoosemiotic one, seems to me to be much more promising (even if it has up to now not been seriously discussed), i.e.: In which way could one interact with these digital creatures as if they were real animals?

Our very long cohabitation with other animals has biologically and culturally modeled our cognitive capabilities. It would be extremely useful to mobilize these capabilities towards these partially autonomous new artifacts and to interact with these artifacts as if they were animals in order to better communicate with them – and it is here that the “message-as-dog” reversal-idea that I have proposed above could reveal its full potential and meaning.

Because artifacts are purely digital in PVW, it means that they are only information. They are then only messages and these messages take the form of animals that would be easier than anything else to be manipulated by humans, in order to interact with other messages. Messages are therefore messages that are animals for other messages – and even humans being themselves only appear there as avatars, i.e. still messages.

Note, too, that the notion of the *functionality* of an artifact itself must be deeply thought about differently in such non-material digital universes. Here, I have not room enough to give a long theoretical discussion on that matter, and will instead give only one example. If I substitute all that data in my computerized storage places with such digital animals, what do I obtain? Information that used to be ‘sleeping’ within such regular storage places now could be constantly activated within the course of multiple syntheses that come from the animalized storage places interacting with other animalized storage places.

Through “breeding” with “conspecifics”, these animalized storage places could generate supplementary (i.e., new) information relevant to those already existing in all the individual animalized storage places involved. To have access to these animalized storage places (essentially, a livestock) allows me an *active* storage space for my data that I can then both use and manipulate through bodily, behavioral or speech complex interactions with them.

In this scenario, untold functions for artifacts could emerge. Because the constraints within a PVW are very different from those within the gravitational and material world, one would be allowed to invent animals that could very different of those we already know – for example animals without any spatial continuity (animals that exist more or less within different locations) or any temporal continuity (animals that exist more or less within different moments) – and to elaborate *ad hoc* very rich semiotic approaches for the interaction with (and between) such animals.

The point at stake is that we could ‘animalize’ information, and learn to handle such informational artifacts in a fruitful and embodied way, by mobilizing the available semiotic resources that humans have acquired through their own specific history with animals. “Negotiable technologies with biographical development” would probably be the most rigorous words one could use to characterize these artifacts, but “to see them like kinds of animals” is both more useful and quicker.

Following that (very brief) discussion, one could understand why the reversal of Hoffmeyer’s idea into “a message could be a dog for another message” – a reversal that would be absurd at first sight – could finally be a fruitful one. One could say that these animals still are messages in PVW, which will be true, but they would not be handled *as* messages, but as animals, or more accurately – animalized messages. A very peculiar form of zoosemiotics could emerges here, one more tuned to the future of animality, perhaps, than to its past. We certainly are still in the realm of fiction here, as of the time of this writing. But the question is: *for how long?*

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DIFFERENCE

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*[Bateson's] famous conceptualization of information as rooted in 'differences that make a difference' comes so close to a genuine triadic Peircean sign as to be nearly indistinguishable.*¹

In 2005, Jesper Hoffmeyer helped organize the Copenhagen Bateson Symposium, which produced the edited volume *A Legacy for Living Systems: Gregory Bateson as Precursor to Biosemiotics*. Jesper Hoffmeyer's own contribution to this conference was a paper entitled "From Thing to Relation: On Bateson's Bioanthropology", and near the end of this paper Hoffmeyer makes the above intriguing remark.

The question that should always be in the back of our mind when conceiving "the difference that makes a difference", however, is: "for whom or for what?" Without that question in mind, it would be possible to interpret Bateson, erroneously, as referring to a simple version of Shannon information – a concept that has now been appropriated by physicists and turned into a 'quantity' (one which exists presumably with 'objective' reference to the proverbial Eye of God, whether God exists or not).

Hoffmeyer, of course, falls into no such error, but to clarify the matter even further, I propose here, on the shoulders of Hoffmeyer, that the answer to the question of: "For whom or what does the difference make a difference?" is necessarily, in Peircean terms: "The interpretant". This is a slightly different answer from a

¹ Hoffmeyer, Jesper 2008. From thing to relation: Gregory Bateson's bioanthropology. In: Hoffmeyer, Jesper (ed.), *A Legacy for Living Systems: Gregory Bateson as Precursor to Biosemiotics*. Dordrecht: Springer, 27–44 (p. 42).

standard second-order cybernetic critique that would want the “for whom” to relate to “an observer”. For as Hoffmeyer points out (2008b: 22), the “interpretant” of a sign is not synonymous with an “interpreter” of a sign. The latter is usually a human being or similar entity, e.g., a “person” – but in his letter to Lady Welby, Peirce both referred to “a person” in his definition of a sign’s *interpretant*, and simultaneously expressed that this is not quite right, but that he despaired of getting his idea across to the majority of his readers otherwise (*ibid*). I will illustrate the nature of the ‘non-personal interpretant’ below, by drawing upon biosemiotic examples from both Bateson and Hoffmeyer.

Bateson introduced the “difference that makes a difference” almost simultaneously in two different papers later collected in *Steps to an Ecology of Mind*. The more well known paper is “Form, Substance, and Difference,” in which Bateson first sets out his differentiation between *pleroma*, the world of forces and impacts, and *creatura*, the world of ‘mind’ in Bateson’s sense. “Difference” is key to the action of *creatura*. But for Bateson, *creatura* (or “mind” in his extended sense) is not the unique possession of linguistic or conscious human beings. Rather, it is a phenomenon that extends throughout the world of living things.²

A key to how this plays out, and why it relates to Peirce’s interpretant, can be found in one of Bateson’s much more obscure papers, also reprinted in *Steps to an Ecology of Mind*, though originally written for the *Journal of Genetics*. This paper, which was written at about the same time as “Form, substance, and difference”, is entitled “A re-examination of Bateson’s rule” – the Bateson of “Bateson’s rule” being Gregory Bateson’s father, William Bateson, the geneticist. In his “Re-examination”, Gregory Bateson attempts to apply the principles of cybernetics to the examination of biological development, as illustrated in the limbs of beetles. In one of his earliest formulations of this idea, Bateson *files* defines information as “any difference that makes a difference in some later event” (Bateson 1972: 381) – a definition which, taken by itself and outside of a cybernetic context, might be misinterpreted in a

² Intriguingly enough, Hoffmeyer notes that *pleroma* relates in Peircean terms to firstness, in some ways, and to secondness in other ways; while *creatura* corresponds well to Peirce’s thirdness (Hoffmeyer 2008a: 31).

physicalistic, billiard-ball causation way. But as his argument develops, his concern is shown to be the way in which each previous state of the animal limb in development constrains, in a cybernetic sense, the development of each subsequent state.

This is so, he informs us, even when the “difference” that triggers further development comes from outside the system. In another favorite Bateson example, that of the frog’s egg, either the entrance of a spermatozoon, or a pin prick from a researcher, will cause a particular meridian to form which then becomes a plane of symmetry for the ongoing development of the embryo. In the case of the beetles’ reduplicated limbs, the upshot of Bateson’s argument is that they reduplicate in the absence of specific information which would *prevent* them from doing so. There is thus a progression of ‘types of symmetry’ in the direction towards asymmetry, and at each step there is information – a difference that makes a difference – which has to be encountered, lest the embryo maintain the previous symmetry.

Such phenomena reflect a layered biosemiotics. Similarly, Jesper Hoffmeyer has introduced us to the concept of a layered bio-semiotics by examining the case of a slap. Considered at the macroscopic level of human interaction, we might consider the interpretant of the slap to be the conscious experience of the person slapped. But at a different layer of semiosis:

“Figure 2.2c shows semiosis in one of the skin’s sensory cells, whose entire architecture and biochemistry create sensitivity to the applications of pressure [...] Here, with the application of pressure, there emerges an interpretant in the form of a context-dependent sequence of action potentials that create a kind of *cellular echo* of the disturbance. This interpretant, the echo, now becomes part of a more complex sign [as represented] in Figure 2.2d.” (Hoffmeyer 2008b: 23)

Likewise in Bateson’s examples, the dynamic state of the embryo at the time when it encounters “information” could be seen as the interpretant of the “sign” that information represents – *if* (and only if) that “information” actually makes a difference, going forward, to the development of that embryo.

Inspired by these biosemiotic examples from both Hoffmeyer and Bateson, my own version of a Peircean reading of Bateson’s “difference” that makes a difference is as follows: The experienced “information” or news, the sensed perturbation that makes a

difference, is (or produces) the primary sign, the sign vehicle. The difference that is made, is the object of the sign. The interpretant, is that to whom or to what the difference is made. It is interesting to me that this Peircean reading immunizes Bateson's difference from non-cybernetic applications. Further, it suggests that a Batesonian 'mind' may be no more and no less than: that which is capable of having differences of such kind, make a difference to it.

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DIGITALITY

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We shall suggest here that the central feature of living systems allowing for self-reference, and thus the ability to select and respond to differences in their surroundings, is code-duality, i.e. the ability of a system to represent itself in two different codes, one digital and one analog.¹

I have struggled with the paper written by Hoffmeyer and Emmeche that is quoted above many times since I first discovered it in the late 1990s; and for many years, I could not understand what I find disappointing about the idea. My answer today (Markoš *et al.* 2009, Markoš, Faltýnek 2011) is that nothing in this word can exist in a purely digital form: ‘digitality’ resides only in the *virtual world* of ‘objective’ reality that is exclusively of our making (Deely 2009) – it is only there that we find numbers, alphabets, syllogisms and terms, *clare et distincte*. Only there can the coding and the copying be absolute, invariant, and error-proof. No internally existing semiosis is required in this idealized, non-physical world of ‘objective’ entities.

Conversely, in the real world, it takes lot of effort to cut things out of the surroundings and sharpen the gaze (or other sensory receptors) to the extent that they then appear quasi-digital, allowing one to forget about their naturally fuzzy contours. Such a “sharpening of gaze” is a true semiotic achievement, and one which is accessible only to living beings. Hence, the quasi-digitality of any given phenomenon – e.g., of DNA, written texts, spoken language,

¹ Hoffmeyer, Jesper; Emmeche, Claus 2005 [1991]. Code-duality and the semiotics of nature. *Journal of Biosemiotics* 1(1): 27–64 (p. 48).

etc. – is conditional, and the result of long-ongoing historical processes and their situated relevant understandings.

Such a state of ossified ‘habit’ can, again as we have learned from Peirce, become undermined by further development, at which point a more open-ended interpretative process will resume. The human-designed world of ‘objective’ entities and genuine ‘digitality’ is, of course, also the result of such habit-formation and evolution – but it is ‘immaculate’ to such an extent that semiosis cannot gain a foothold in it?

I therefore fully agree with Hoffmeyer and Emmeche’s statement that “*nothing digital in the world can function by itself*” (Hoffmeyer; Emmeche 2005: 68). Digitality is a mode of understanding that has been created by human beings, and exists only embedded within the virtual world of ‘objective’ reality. In contrast, quasi-digitality is the phenomenon belonging to the surrounding natural world, and has been kept up by never-ending efforts of living systems. As to the functions of such quasi-digitality: it enables all of life’s inscribing, bookkeeping, proliferating and storing of information that is itself non-living.

“Life is artifact-making”, writes Marcello Barbieri (2008) – which I understand as saying: Life is, apart from many other phenomena, the stream of semiotic processes leading to quasi-digital records that enable living beings to save some living experiences in a form that allows their easy storage and retrieval.

I thank you, Jesper and Claus, for this inspiration. And I hope we shall be able to discuss the topic deeper – in the near future.

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DOUBT

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The will to reason is ultimately a question of morals. We can defy reason – for instance, if we don't believe it to be the deepest truth about a subject matter – but if we avoid listening to reason, we will end up corrupted. In this sense, thoughts are an eternal source of doubt that we are morally obliged to keep flowing. [...] Unfortunately, the scientific community has moved towards an arrogant claim of its own reason as being downright identical to reason as such. In sharp contrast to what has been held to be a core strength of research – systematic doubt – quietly “agreement” and “consensus” have become positive words in science, most clearly seen in the discussion about global climate. [...]

To a large extent, however, it has been scientific disagreement that has secured the soundness of scientific progress. Researchers are not braver than other people, and it takes courage to go up against a consensus between the powerful politicians in one's field. And the more the politicians invest all their money on so-called strong research groups, the less space is left for doubt, and the more difficult it becomes for outsiders to survive in the system, let alone pursue a career. There are grounds for fearing that doubt and disagreement may be neglected or directly suppressed in the modern system of research.¹

It has hardly escaped notice that the seminal contributions to biosemiotics by Jesper Hoffmeyer are embedded in his wider critical appraisals of the modern scientific worldview and its troubled relations to enlightenment, metaphysics and other forms of human experience. As a follower of Hoffmeyer's extensive work throughout most of his career – I read his first book on scientific

¹ Hoffmeyer, Jesper 2009. Argumentets moral. [The moral of argument.] In: Hoffmeyer, Jesper, *Tro på Tvivl: Kritik af religiøs og videnskabelug uformuft.* [Believe in Doubt: Critique of Religious and Scientific Unreason.] Charlottenlund: Ries, p. 15–16 (trans. by C. E.).

reductionism (1975) while still at high school – I have benefited from his constant emphasis on the critical aspects of science, and his insistence that exactly the promise of a truly scientific world view has not yet been fully achieved, and cannot be so, as long as science clings to an outdated dualist metaphysics.

Most biologists raised in the paradigms of contemporary evolutionary or molecular biology are epistemically socialized into the belief that the already established theoretical frameworks will prove sufficient to explain (eventually, in a more distant future) the whole realm of life – including the mental life of human beings, our actions, thinking, communication, perception, cognition, and qualitative experience. Only a few philosophers dared to declare the problem of consciousness – of how to account for the emergence of phenomenal experience in a purely physical and chemical world – to be not only hitherto unsolved, but ‘hard’ in principle, as it could seemingly only be posed either as a hopeless search for reduction of complex meaningful behavior or cognition into genes, proteins and other physical components of living cells, or as a futile search for bridges between worlds that from the very beginning were conceived of as separate realities: i.e., that of the body and that of the soul.

In a spirit of profound doubt about the traditional way of posing the problem of grounding human mind and social reality in a scientific understanding of nature, biosemiotics constitutes a principled dissent to the received dualist and materialist views. And far from claiming to have completed an alternative account, as a field it has articulated our doubts about established paradigms – indeed, we have even learned to cultivate and cherish internal disagreements, as displayed in writings and conferences, about exactly how to use semiotic concepts to build a better foundation for our understandings of life and mind.

Through his work in communicating new science to a wider public in Denmark, Jesper Hoffmeyer has contributed in important ways not only to open up science and to make its findings relevant to the lived experience of people, but also to provide a profound perspective for seeing new connecting patterns between life, the universe and (almost) everything. As hinted at in the quotation above, Hoffmeyer has never been blind to the ‘mafiosic’ aspects of established science – and this has made his own career track slightly

more non-linear, and perhaps ultimately forced it to be groundbreakingly creative.

It serves greatly to his credit to have had the courage to speak up against the prevailing dogmas of both his own field of science, and of the popular understanding of science as providing a world picture deprived of human meaning and significance. Here, Jesper Hoffmeyer's biosemiotic analyses are far-ranging, implying more than just another scientific specialty. They amount, instead, to a radical new and relational understanding of human nature and the possibility of using the 'common sense' (or *sensus communis*) of human reason in its full scope, as an instrument not only of fallible measurement, but also of a deeper understanding of the relations between subjectivity and objectivity ... not so little a contribution to the furtherance of all sciences in their totality.

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DUALITY

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*The invention of 'digitality', I suggest, was the step which some 4 billion years ago allowed certain swarms of communicating closed membrane systems floating in the prebiotic mud to escape the indifference of the mere moment and to enter a temporal world of genuine selfhood.*¹

In the poetic citation above, Jesper Hoffmeyer has created a semiotic genesis fable – one which singles out the creation of an inheritable memory storage system, free from the constraints of physical laws, as the most important invention in the creation of life. In this view, the innovation of “digitality” facilitated the first equilibrium between the primordial membrane systems – which had previously communicated exclusively by analog codes – and started the endless evolution of punctuated equilibria. Now, 4 billion years later, in all living cells, we witness the outcome of this fortunate accident in its modern semiotic system of interconnected, but functionally separated, Digital and Analog codes.

As Hoffmeyer points out on many occasions, this code duality is a prerequisite for the evolution of living organisms – but he also states more philosophically that the “*two equally necessary forms of referential activity arise like twins in the individuation of the logic that we call life*” (Hoffmeyer 2001: 128). Life as we know it thus created – and at the same time requires – the presence of two complementary semiotic systems, acting at different logical levels.

¹ Hoffmeyer, Jesper 2001. Life and reference. *Biosystems* 60(1/3): 123–130 (p. 126).

But did code duality arise when hereditary memory systems were introduced into life? The RNA-as-origin-of-life believers, who now form a large congregation, postulate that life in the primordial soup was solely based upon RNA molecules, and that these macromolecules functioned as biological catalysts like enzymes in current life forms, as well as hereditary molecules like present day DNA (Benner *et al.* 1989: 7054). In this creation scenario, the code duality was not firmly established from the start, even though the perquisites for it were present. But because a direct copy of some part of the genetic storage molecule was used as catalyst, a complete separation of the digital storage system and the analogue cell factory was not possible.

The invention of double stranded DNA as a long term storage molecule, however, removed the hereditary molecule from the functional (i.e., analogue) domain, because its helical structure does not reflect the DNA sequence. The only place where the DNA sequence information is reflected on the helical surface is in the major groove that runs around the helix, where specific DNA binding proteins may interact with the paired bases and recognize small specific sequences. The rewriting of the RNA code into DNA sequences at first only offered DNA a bookkeeper function in the cell, however.

The breakthrough organism postulated by Benner *et al.* (1989: 7054) – i.e., the last organism to use RNA as sole genetically encoded catalyst – can be inferred to have had a complex metabolism, but may have used DNA for storage of hereditary material. Thus, already this hypothetical organism had a semiotic system that was based upon code duality. A total separation of the digital and analogue system was ensured, with no reversion possible, when the RNA catalysts (ribozymes), after millions of years, invented a new type of more diverse and efficient catalytic macromolecules, the proteins, based upon a peptide backbone with a large variety of functional groups. The synthesis of proteins was then coupled to an ingenious representation system, where each different functional group in the protein was represented by a triplet of RNA bases. This innovation was the second great semiotic hallmark in evolution.

One may speculate about why the code duality is such a powerful trait that it can select for the invention of protein-based

catalysis, and an effective genetic coding system, through chance mutation and recombination events. In chapter 7.2 of Jesper Hoffmeyer's *Biosemiotics* (2008), he briefly introduces my proposed linear representation of the triadic sign model (Hoffmeyer 2008: 258) that was invented by Charles Sanders Peirce. Here I wish to show briefly how one may formalize semiotic representation functions in the digital and analogue systems using this linear formalism.

First, let us consider the analogue representation functions, formalizing the induction of gene expression in a unicellular organism, where square parentheses indicate concentrations ($[mRNA^A]$ in the concentration of mRNA from gene A):

Inducer:-- $[mRNA^A]$:-- $[Enzyme^A]$:-- Reaction rate^A:--
Metabolic rate:-- growth rate

We may here say that the growth rate is representing the metabolic rate, which is again representing the enzyme reaction, etc. One semiotic triad can be constructed, which contains the three sign elements: $[mRNA^A]$:-- $[Enzyme^A]$:-- Reaction rate^A. The elements form a genuine triad, because the inherited memory of the cell has produced a protein synthesis machinery and a protein folding pattern that links mRNA levels, enzyme levels, and enzyme reaction rates. This is close to what Hoffmeyer hinted at in his sentence: “*The analogically coded messages correspond to a kind of tacit knowledge hidden in macromolecular structure and shape*” (Hoffmeyer 2001: 123). Similar arguments can be put forward for any other triad involving the sign elements above.

In the digital domain, we may write a different chain of representation, formalizing the evolution of protein^A by mutational events:

Mutation:-- DNA sequence^A_{i+1}:-- mRNA sequence^A_{i+1}:--
Protein sequence^A_{i+1}

Here it is clear that the digital sign triads are of a different nature than the analogue triads, and that there is no way an altered protein sequence can be tested within the digital domain. A DNA sequence could be tested directly if the organism had a desired output sequence to compare with, but in evolution, based upon the fitness of whole organisms, the fitness gain from a new protein sequence

can only be tested in the analog domain. But by including the representational relation:

Protein sequence^A_{i+1}-- Protein function^A_{i+1}-- Reaction rate^A_{i+1},

we can bridge the gap between the analogue and digital semiotic systems, where the protein function belongs to the analog domain. For the evolved cells (version i+1) and the parental cells (version i), respectively, the following chain of representations are operative:

Protein sequence^A_{i+1}-- Protein function^A_{i+1}-- Reaction rate^A_{i+1}--
Metabolic rate_{i+1}-- growth rate_{i+1}

and:

Protein sequence^A_i-- Protein function^A_i-- Reaction rate^A_i--
Metabolic rate_i-- growth rate_i

We have here shown a simple semiotic analysis that transcends the apparent paradox of code duality, and formalizes how changes in the digital domain can be tested by their effect on cell growth in the analogue domain. We have, however, not yet shown why such code duality *per se* has such a large selective advantage, so this question must be dealt with at a later point.

But for the moment: Happy Birthday to Jesper, who pioneered the concept of code duality!

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EMANCIPATION

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*Every organism on Earth is tossed at birth into this semiosphere [... but still] we tend to overlook the fact that all plants and animals [...] live, first and foremost, in a world of signification. Everything an organism sense signifies something to it.*¹

I began the task of selecting a passage by re-reading *Signs of Meaning in the Universe* (1996), with the intention of moving on to other writings by Professor Hoffmeyer. By the third paragraph of the Preface, I encountered a worthy candidate.

For fear of being dismissed as a champion of the obvious, I marked the above sentences only as possibilities and continued my search, stumbling rather quickly upon another claim of fundamental importance. “Like Peirce I prefer,” Professor Hoffmeyer confesses, “a philosophy which enables one to comprehend the world as a place where spontaneity is not rejected out of hand and where one can therefore entertain the thought that something radically new – i.e., essentially unpredictable – might be generated” (1996: 27). It is indeed always heartening to me to see a scientist break a lance in defense of *tychism* (the Peircean doctrine of absolute chance). At the end of the chapter in which we encounter this revelation, however, we encounter another one, no less forcefully articulated: “I am,” Jesper divulges, “somewhat skeptical of this worship of the God of Mathematics,” he writes, immediately adding, “I have a suspicion that deep down, Galileo’s credo [that the book of Nature is written in the language of mathematics] is an expression of human reason’s wish that the world should always resemble reason itself” (*ibid.*, 38).

¹ Hoffmeyer, Jesper 1996. *Signs of Meaning in the Universe*. Bloomington: Indiana University Press, p. vii.

But Human Reason has in some quarters given way to human intelligence and simply animal ingenuity. Such intelligence is, at bottom, the capacity to learn from experience, i.e., the ability to derive information and even insight from our errors (cf. Peirce, *Collected Papers*, 2.227). “The tendency to make mistakes lies at the root of all true development in this world” writes Hoffmeyer (1996: 144; cf. 145). Similarly, the propensity for things to go awry underlies any development – often proving over the course of time to be advantageous for some species, community, or individual. This is true at all levels, as Jesper notes: “If no errors had ever arisen in the DNA molecules, life would never have progressed beyond the amoeba stage.” (*ibid.*, 144–145; cf. Peirce, *Collected Papers*, 6.86; also 1.9).

In assembling these passages, I was struck in several instances by the prominence of “*I*” (“I prefer ...”; “I am somewhat skeptical ...”). No misstep here. “At some point the neo-Darwinists are going to have to lift their heads and face the fact that the problem of subjectivity cannot be spirited away” (Hoffmeyer 1996: 57). A philosophical desideratum is, at least for those not brow-beaten by eliminativists of various stripes (and Jesper is not one to be brow-beaten by these or any other militants), a theory of the human organism that is inclusive of an account of our ineliminable subjectivity.

Later, yet another passage locked me in its embrace: “Humanity does not have its roots in responsibility, but human beings are responsible for their roots” (*ibid.*, 137–138). This point potentially deepens our understanding of subjectivity precisely *as a task*. Whatever else the *I* is, s/he is a being who must hold itself responsible for its origins, at least its roots.

If we count not the individual sentences but the distinct clusters of them, we have *six* passages (the first bearing on the semiosphere, the second on tychism, the third on the idolatry of mathematics, the fourth on fallibility, and the fifth on subjectivity) – and we hardly find an authorial voice other than Jesper Hoffmeyer’s own. Each one of these claims might, for rhetorical purposes, be personified; that is, each one might be cast as characters in an ongoing intellectual drama (e.g., the biosemiotician, the anti-formalist or pragmaticist, the tychist, the fallibilist, the defender of subjectivity [though not a personage to be confused with the subjectivist!], the humanist, and by implication of course the ecologist). But space

does not allow me to do much more than introduce these characters to you. So, I am inclined to say that all I have managed to do is assemble: Six Characters in Search of an Author!

To complicate matters still more, allow me to introduce an historical figure (who was in his own right a real character!). What Charles Darwin realized even before the publication of *Origin of Species* in 1859 is even today not fully appreciated. In an entry in one of his notebooks, Darwin wrote: "To study Metaphysics, as they [*sic.*] have been studied[,] appears to me to be like puzzling at astronomy without mechanics. — Experience shows the problem of mind cannot be solved by attacking the citadel itself — the mind is function of body — we must bring some stable foundation to argue from" (*Notebook N 5*, October 3, 1838). Rather than attacking the mind itself, let us situate mindful organisms in the actual world in which they incessantly carry out their semiotic transactions (in brief, let us see organisms *as agents* in the semiosphere).

If we are today closer to an adequate appreciation of this epochal insight, however, it is in no small measure due to the singular genius and indefatigable effort of Jesper Hoffmeyer. What Peirce appears to have discovered while still a youth — the centrality and ubiquity of signs not only in our lives, but also in the life of the cosmos itself (see, e.g., Lee Smolin's 1997 book of that title) — still is even among most of our contemporaries overlooked or dismissed. Here, too, the genius and labors of Jesper have been invaluable in winning a fuller and fairer hearing for such Peircean insights in their full sweep and unmeasured depth. The signs of life are nowhere more dramatically present than in the life of signs, from the sunflower turning toward the sun (Peirce, *Essential Peirce*, volume 2, p. 273) to the trained experimentalist opening the dusty folios of the medieval schoolmen — or another trained scientist opening the seemingly esoteric texts of a "philosophical crank" and discerning therein a philosophical genius whose own intellectual labors not only opened a vast field of heuristic adventure, but also nothing less than an emancipatory perspective. For Hoffmeyer's perspective frees us from the debilitating forms of scientific reductionism so deeply entrenched in certain circles of the contemporary world, without returning us to vitalism or any other untenable position.

While this perspective frees us *from* the myriad forms of theoretical reductionism, it frees us *to* take up the phenomeno-

logical, normative, and metaphysical (including cosmological) tasks so vital for a robust renewal of the philosophical enterprise, at least in its Peircean sense. Far beyond the single work on which I have drawn, virtually all of the writings of Jesper Hoffmeyer prove not only the possibility of such an approach – but also the value of envisioning our task in this manner. The possibility of flight is most dramatically proven by the ability birds and other organisms actually to bear themselves aloft, while the advantages, exhilaration, and perils of flight are most deeply ascertained only by creatures who exercise their remarkable power of such unfettered ascent. For humans, this means as much as anything bearing ourselves aloft on the wings of imagination. “Imagination,” as Jesper so sharply observes (and he should by all means have the last word), “is the creative exploitation of error” (p. 145; cf. Peirce, *CP* 1.46–48).

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PROOF

EMERGENCE

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*A stable integration of a self-referential digitally coded system into an other-referential analogically coded system, may perhaps be seen as a definition of life.*¹

Jesper Hoffmeyer's work has been fundamental in establishing biosemiotics as a cross-disciplinary field, providing scientific grounds for the existence of meaningful systems in the natural world. Hoffmeyer's collaborator, Donald Favareau (2009), explains that biosemiotics is about finding the relation between biological organization and mental experiences. Thus, biosemiotics locates the production of meaning at the level of living processes, not just in the human mind as producer of sign relations.

This position, originating in Charles S. Peirce's pragmatism, contemplates scientific theories (ideas represented by sign systems) as dynamic working hypotheses, so that the notion of explanation becomes fundamentally sociological and purposive, enhancing the importance of relationships, either between organisms and their surroundings (context) or between organisms and other organisms (intersubjectivity). At the micro-biological level, this approach means that genes and chemical molecules carry 'potential' information, which only becomes 'realized' through acts of interpretation or 'aboutness', in Hoffmeyer's terms, in the acquisition of biological meaning. In turn, this implies the need for entities which are

¹ Hoffmeyer, Jesper 2010. Semiotic freedom: An emerging force. In: Davies, Paul; Gregersen, Niels Henrik (eds.), *Information and the Nature of Reality: From Physics to Metaphysics*. Cambridge: Cambridge University Press, 185–204 (p. 194).

dynamically dependent on the outside world, so that membranes (whether cellular or cultural) are understood as interfaces connecting inside and outside (signal transduction), an idea also present in contemporary representations of cultural systems (see for instance work by Juri Lotman or John Deely).

My own research has focused on the study of artistic representations as meta-cognitive, staging processes of ambiguity, grounded on changing patterns for the support and transfer of information. Interdisciplinary analyses show that changes in the use of technological tools (from the telescope to the computer screen) affect human communication with the world, and also human cognition. Contemporary research on intermedial semiotics, applied in particular to digital environments, points to the fact that tools that enable communication at a distance create a separation of information from its original context of production. In this scenario, the metaphor of 'membranes' or 'borders' between organisms or systems becomes less important, and emphasis is shifted from considerations of 'space' to aspects of relationship grounded on dynamic systems and processes, a complicated loop, since the human mind tends to conceptualize in terms of space/position (Bouchardon, López-Varela Azcárate 2011).

The perilous question is whether there exists the possibility of linking social and cultural behaviour, and developments in neurosciences. In other words, if higher-level patterns can be established through a situated exchange of signs between sub-components, what Hoffmeyer terms '*biosemiotic emergence*'. This would imply a connection between semiotic emergence, including, at the macro-level the development of human capacity for making inferences drawing from perception, previous conscious knowledge, emotions (some unconscious), balancing considerations against each other – that is, involving value systems (Churchland 2001), and downward causation to lower levels operating through indexical sign relations.

Contemporary research is rapidly providing evidence for the possibility formulated above. My own studies have been seeking a revision of the ontology of perception and of the emergence of human communicative potential by relating neuro-scientific research and socio-constructivist understandings of human physical development, and integrating these findings with the evolving nature of the technical media that social beings use to communicate at a

distance. Thus, I have revised contemporary research on mirror neurons structures that relate stimuli from limited portions of space, perceived through our senses as proto-objects by means of index assignment. Properties and relative locations of a small number of objects can be retained in working memory from just one unconscious fixation to another (in the case of visual perception, for instance). Indexes operate as deictic pointers (like demonstratives in language) such that they provide a link between visual objects and mental objects (signs) without requiring that either be labeled or categorized.

Working memory only makes dynamic use of deictic variables so that proto-objects are indexed as future targets for motor commands (task-oriented to rapid changes in the environment) including the command to direct conscious gaze to the object. In other words, objects are detected without being conceptualized (that is, without encoding any sensory properties). This sort of binding is available as long as an indexed object remains in view and perhaps for a short time thereafter. What this means is that orientation is first directed towards the temporal, rather than the spatial aspects (that involve marks, tags and categorization). Focal (spatial) attention is employed subsequently to individualize items (see, for example, Zlatev *et al.* 2008).

Let us now return to Hoffmeyer's quotation at the start of this contribution, the fact that organic life may be contemplated as "the integration of a self-referential digitally coded system into an other-referential analogically coded system". Such an assertion not only captures the difficulties of translating (machine/artificial) mathematical binary code, made up of unambiguous units, which build into larger unambiguous structures by means of internal index-replication, into the ambiguities of human communication, open to outside-other (natural) languages. It also points to the fact that micro and macro levels, just as digital and analogue systems, may *operate* differently, even when following similar replicative mechanisms.

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PROOF

EMPATHY

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*It is through empathy that we become human.*¹

Like Jesper Hoffmeyer, who introduced me to the world of biosemiotics, I share the idea of the evolutionary connectedness of all natural beings. However, I differ from him in stressing in my own work the need to theoretically include every self-organising system within the realm of sign producers. I would like to paraphrase Jesper by saying that the universe is perfused with all kinds of agents – all of which are capable of generating and using signs according to the stage they happened to reach so far in the course of evolution. Such agents might be material systems that organise themselves, or living material systems, or human living systems.

Humans, of course, are special. Through their capacity for empathising with other life-forms, they have managed to split the symbolic and collective mind from the material and biological body – a split that Hoffmeyer holds largely responsible for our many false beliefs. However sympathetic I am to Hoffmeyer's criticisms of those false beliefs – and however supportive I am of his idea that *empathy* is a unique feature of humans that has to be put in biosemiotic and evolutionary perspective if we are to master the accumulated crises that humanity is facing today – I feel a need not only for relating empathy to those precursors on nonhuman levels (including those of prebiotic agents), but also a need for relating empathy to different semiotic functionalities at the same evolutionary level: that is, to cognitive, communicative and co-operative

¹ Hoffmeyer, Jesper 1996. *Signs of Meaning in the Universe*. (Haveland, Barbara J., trans.) Bloomington: Indiana University Press, p. 133.

abilities according to my so-called triple-C Model (Hofkirchner 2002).

Regarding nonhuman precursors, there is evidence that some species may have the ability of perspective-taking – not only apes, but also monkeys, dogs, and birds are said to show that at least, under specified circumstances (see the literature cited in the notes to pages 99 and 100 in de Waal 2009: 243). Generally speaking, what living systems, starting with the unicellular organisms, are able to do is to anticipate what a conspecific is going to do (see Table 1: line 2, cell 2). But taking a conspecific's point of view involves a certain amount of disentanglement between one's own self and another self. Such entanglement could certainly be hypothesised as the material precursor of empathy in primitive, physical self-organising systems (see Table 1: line 2, cell 1). Perspective-taking, then, seems to be an advanced form developed from unconscious bodily connections that account for the emotional part of empathy. For de Waal "volunteering of information is not entirely absent in apes" – however, he admits "that they are less inclined than humans to engage in such behavior" (Waal 2009: 252). So empathy as a systematic feature pertains properly to humans (see Table 1: line 2, cell 3).

This leads to the second issue, which concerns the relation of empathy to different semiotic functionalities at the same evolutionary level. Rakoczy and Tomasello (2008) concede second-order intentionality to chimpanzees – intentionality being here defined as the understanding of others as perceiving and acting agents, in the context of social manipulation and competition. Ontogenetically, humans go even beyond that state in their interactions with one another, and enter into a kind of third-order intentionality: so-called shared or collective intentionality. In that respect, I propose to make a creative use of Charles Sanders Peirce's idea of firstness, secondness and thirdness (Peirce 2000).

The level of thirdness is reached when humans co-operate – that is, when they share a common goal, and communicate and cognise accordingly. Tomasello and Rakoczy (2009) estimate that by around four years old, most children are able to utter intentional propositions – that is, propositions made up of a meta-level proposition containing psychological verbs like "believe, think, know" and an object level proposition that complements the former (Tomasello,

Rakoczy 2009: 721–724). This is the function of shared intentionality (see Table 1: line 3, cell 3).

The level of secondness, human communication, is shaped by shared intentionality. It is laid down in the pre-linguistic capability of infants to carry out proto-imperative and proto-declarative gestural communicative acts (Rakoczy, Tomasello 2008). This is the level of empathy as a necessary condition for shared intentionality (see Table 1, line 2, cell 3).

The level of firstness, human cognition, is, eventually, shaped by empathy. I call this capability reflexivity (see Table 1: line 1, cell 3). Human reflexion enables humans to reflect upon themselves, and to reflect themselves as part of a bigger picture – i.e., from the immediate social system all the way up to society itself. The actions of members towards other members of society are mediated by this “third”: the structure of society.

The other cells in the table given here are filled with terms that signify several other categories of semiotic functionalities and capabilities deriving from the framework, but not to be discussed here, because of limitations of space.

Table 1. Semiotic capabilities in functional and evolutionary perspectives.

Semiotic capability	in material systems	in living systems	in human systems
cognition	<i>responsiveness</i>	<i>affectivity</i>	<i>reflexivity</i>
communication	<i>entanglement</i>	<i>anticipation</i>	<i>empathy</i>
co-operation	<i>collectivity</i>	<i>collective intelligence</i>	<i>shared intentionality</i>

Let me conclude. To my mind, empathy is a necessary step for the healing of civilisation, just as it is in Hoffmeyer’s sense. But empathy needs complementation by a certain instance of shared intentionality to actually ensure a humane life in sustainable connections with all the other agents populating the world that is our homeland. By saying that, empathy is not belittled, but rather, put in a context that makes it still more important. I am very much indebted to Jesper, as he originally made me feel how decisive it is to deal with empathy.

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PROOF

ENERGY

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[...] *I have argued that it is therefore the same two parameters – the magnitude of the flow of energy and the semiotic controls guiding the utilization of that energy – that have constituted the pivotal points in both the historical project of civilization, and in the evolution of life on earth.*¹

Jesper Hoffmeyer proposes that the optimized environment and organism relationship that has developed via evolutionary mechanisms might be called *semiotic fitness*, and expresses the fitness ratio with a formula $S/E=I$ (where S is the efficiency of the semiotic control of life processes and E the magnitude of energy flow canalized through the system). Applying the formula to modern times, he finds that the possibilities for extracting ever growing magnitudes of energy that the industrial revolution opened up have not been accompanied by the development of corresponding control mechanisms for directing the energy flows. The latter (lack of) development can thus be seen as one of the major sources of the current environmental crisis.

Weighing the human state of affairs in energetic terms has cropped up now and then in history, but this is not to say that all those lines of thought have carried the same agenda. The following sketch will give just a slight hint of this by comparing Hoffmeyer's formula with the ideas of two 20th century authors from the fields of anthropology and economics.

In the 1940s and 1950s the American anthropologist Leslie A. White (1900–1975) revived the tradition of evolutionary anthropology with his ideas about the progression of human culture

¹ Hoffmeyer, Jesper 2008. *Biosemiotics: An Examination into the Signs of Life and the Life of Signs*. Scranton: University of Scranton Press, p. 345.

through a number of developmental stages, recalling thereby his anthropological predecessor Edward B. Tylor in the 1880s. However, time had passed and White was intrigued by ideas concerning living systems as energy-capturing systems (Alfred Lotka) as well as more specifically the thermodynamic principles in the development of life and life as a negentropic system (Erwin Schrödinger). While picking up those threads, White also cast the development of culture into energetic terms, as Wilhelm Ostwald and Joseph Henry had done before him.

White claimed that the major difference between humans and animals lies in their significantly different ways of capturing energy. Although the human employs the organs of his/her body in the process of control over his/her environment, as do other animals, s/he also possesses a powerful extrasomatic mechanism – culture (White 1959). White took culture for a material and thus also for a thermodynamic system: “Culture is an organisation of things in motion, a process of energy transformations [...]. It is an organization of energy transformations that is dependent upon symboling” (White 1959: 38).

According to White, cultures developed by increasing their control of energy sources: from fire to animal power, to coal, to oil, to electricity, to thermonuclear power (cf. Sutton, Anderson 2004: 19). With each successive stage, the magnitude of extracted energy had been growing. White summed up the development of cultures with a formula $C = E \times T$, where C corresponds to culture, E to energy and T to technology. He also phrased it in the form of a law of cultural development: “Culture advances as the amount of energy harnessed per capita per year increases, or as the efficiency or economy of the means of controlling energy is increased, or both” (White 1959: 56). Those ideas of Leslie White were written in a fully modernist context, whereby the amount of extracted energy contributed to the development of higher levels and forms of culture, to a praiseworthy progression without any foreseeable end.

A couple of decades later, in the 1970s, the Romanian economist Nicholas Georgescu-Roegen (1906–1994) blurred the bright outlook of the human exosomatic extraction of energy with a dark hue. Georgescu-Roegen is known for having coined the term *bio-economics* for a new approach in economics: “The term is intended to make us bear in mind continuously the biological origin of the

economic process and thus spotlight the problem of mankind's existence with a limited store of *accessible* resources, unevenly located and unequally appropriated" (Georgescu-Roegen 2011 [1978]: 103). He adopted the terminology of *exosomatic* organs from Alfred Lotka to refer to the "detachable limbs" humans have invented to extend the range and scope of their activity (Messner, Gowdy 1998).

Contrary to White, for whom culture as an extrasomatic device contributed to the continuous progress of mankind, Georgescu-Roegen found that the sources of social inequality and stratification as well as environmental problems lie precisely in the limitless exosomatic evolution and the human addiction to the products of pleasure generated in this process. He warned that as far as those products depend on finite stocks of available energy and matter, our obsession with consumption collides with the unavoidable biophysical limits (cf. Messner, Gowdy 1998).

Although the concerns for the limits of energy extraction are echoed in the above mentioned ideas of Hoffmeyer, the solutions offered diverge from those of Georgescu-Roegen. Whereas Georgescu-Roegen calls for the taming of human greed that does not halt before the limits of availability, Hoffmeyer rather suggests the improvement of technologies in a manner that would encompass and correspond to the biosemiotic control principles found in living systems. Whether one or the other should be a starting point for tackling the environmental problems at hand, is still an issue of debate. But as long as the two serve as mutual impetuses for developing each other's arguments, the eradication of either of them would be a step towards a world of homogenized reasons and answers.

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ENKINAESTHESIA

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*The semiosphere is a sphere like the atmosphere, hydrosphere, or biosphere. It permeates these spheres from the innermost to outermost reaches and consists of communication: sound, scent movement, colors, forms, electrical fields, various waves, chemical signals, touch, and so forth – in short, the signs of life.*¹

There is something gloriously life-giving about the writing of someone who has observed the world closely, thought carefully, and yet writes so freely about profound matters. This is my experience of reading Hoffmeyer's work and, although I quote only one passage above, it is reading it in the context of some of his later writing (i.e., "Surfaces within surfaces", the second chapter of Hoffmeyer's 2008 Biosemiotics volume), that has brought about an epiphany in my thinking about consciousness and sensuous co-agency.

Hoffmeyer's expression of the profusion of ways in which things, agents, elements, quarks, cats and chemicals are interacting awakened in me the reality and beauty of Kant's Third Analogy of Experience (Kant 1929: 233–238). It is a passage in which Kant claims that all things exist in relations of community and reciprocity, and it is a passage over which there has been a great deal of, sometimes important, speculation. What was so striking in reading Hoffmeyer's passage was that Kant's claims could now be grounded in physical science; that philosophical analysis was fine, but if we were going to understand the implications of Kant's claim, then an examination of the ways in which organisms, cells, and so on,

¹ Hoffmeyer 2008: 5 (also in Hoffmeyer 1997).

communicate – through “sound, scent, movement, colours, forms, electrical fields, various waves, chemical signals, touch, and so forth” – would be invaluable.

So, here were the essential triggers: (i) the mention of touch, because I’d been considering the absence of affect in cognitive models of consciousness, and ‘touch’ is a word characterised by its nuance; (ii) the mention of communication that is deemed to have meaning for the life in the midst of it; and relatedly, (iii) the extension of the semiosphere throughout the atmosphere, the hydrosphere and the biosphere – in fact, throughout a universe that in all of its being, from the quantum to the cosmological, matters to the life that constitutes and configures it, in their relations of community and reciprocity. For too long, cognitive models and theories of the mind had concentrated on individuals as self-contained agents, as Cartesian egos, with clearly defined mental and physical boundaries. And this is where Chapter 2 of *Biosemiotics, An Examination into the Signs of Life and the Life of Signs* (2008: 17–38) is so important.

In it, Hoffmeyer writes about the skin, with its surfaces within surfaces which belie our natural assumption to see the boundary of the body as the limit of our experiential world. Rather, he reminds us, there are the biological membranes of stratum corneum, epidermis, dermis and subcutaneous tissue, and our sense receptors and nerves; then there are the hairs that respond to temperature, which can stand erect if we are suddenly fearful, and which can be brushed by a sleeve or touched gently by a breeze; and then there are the non-biological membranes of clothes with their textures and degrees of translucency, and our personal and social boundaries which vary in relation to our moods and emotions: our confidence, our company, our feeling of well-being and health, and so on. It is precisely this, the semi-permeable nature of our skin, which provides us with the possibility of experience in the first place. Being overrun with an abundance of receptors – sixty kilometres of nerve fibres, fifteen kilometres of veins, with millions of sense receptors for pain, temperature, pressure and touch – it both opens us up to the world and discloses it through our inescapable engagement with it.

And touch, Hoffmeyer reminds us, is only the beginning: our engagement is richly pleni-sentient, fully ‘switched on’ proprio-

ceptively, kinaesthetically, visually, aurally, and tactilely; to the proximal and the distal, from the innermost to outermost reaches of our experiential entanglement with those things which have meaning for us, and about which we are concerned – whether we are horse, cat, beetle or human being. We are both observers and observed, both the subjects of experience and the objects of other's experience, living within a modally and socially complex horizon of dynamic affective enkinaesthetic relations: affecting other feeling sensing bodies and being affected by other agents and things. We routinely spill over into each other's experiential life, for that is how communication is most effective; it affects us and matters for us, and that can only happen if we live within a semiosphere that is co-extensive with the biosphere and consistent with an ethiosphere – the sphere of our concernful-engagement.

In closing I would like to say that there was nothing routine, in the sense of commonplace, about Jesper Hoffmeyer's work spilling over into my experiential life; in truth it has been a most extraordinary piece of good fortune and a most effective communication of ideas within our living and breathing semiosphere.

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EPISTEMIZATION

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*Epistemizing the inherent holism of the subject-object relationship was a maneuver [...] that protected physics from the troublesome subjectivization of nature that would have brought it into conflict with the ideal of science.*¹

I am indebted to Jesper Hoffmeyer for his references to my early ideas on codes and scientific epistemology. His paper with Claus Emmeche (1991) on code duality was responsible for stimulating my interest in biosemiotics, a field I did not know existed. My first impression was that we were in general agreement. However in his recent book, *Biosemiotics*, Hoffmeyer (2008: 92–96) questions both my dual modes of description, as well as the *epistemic cut* that physicists regard as inescapable. Instead of seeing the cut as a requirement for empirical tests of theories, Hoffmeyer sees the epistemic cut itself as a “paradox” that he hopes to “transcend” by a Peircean cosmology.

As noted above, Hoffmeyer claims that “epistemizing the inherent holism of the subject-object relationship” was a “maneuver” used by von Neumann and Pattee (and quantum theorists) that “protected physics from the troublesome subjectivization of nature that would have brought it into conflict with the ideal of science” (2008: 318). I would say that the ideal of science is empiricism – conforming theory to experiment – and that this implies a necessary epistemic cut.

¹ Hoffmeyer, Jesper 2008. *Biosemiotics: An Examination into the Signs of Life and the Life of Signs*. Scranton: University of Scranton Press, p. 318.

Why is this so? The condition for the objectivity, or universality, of laws is that they appear to be the same for all conceivable systems and to all conceivable observers. Consequently, an individual system cannot be distinguished by objective laws alone. Any experimental test requires a subjective agent, or an observer, to *choose* an individual system for examination. This choice is largely arbitrary, but it must be made explicit if the concept of *experiment* is to have any functional meaning. This choice *is* the epistemic cut. Of course, Hoffmeyer (like everyone) may choose where to make the cut. He chooses to see the subject-object relation as an ‘inherent holism,’ but to call it science, he must also choose a subjective test of such purported holism.

Instead of such “epistemizing,” however, Hoffmeyer believes that: “By positioning the sign process (semiosis) as an irreducible ontological category in our universe, biosemiotics (standing on the shoulders of Peircean cosmology) has definitely put itself beyond this methodologically justified limitation of the scientific understanding of the world” (2008: 318). I would simply say, instead, that Peircean ontology puts us beyond any scientific model of the world. Of course, there is nothing wrong with non-scientific models. In fact, humans live mostly by religious and cultural models. What is wrong is calling them scientific, when there is no empirical test.

When it comes to empirically decidable models, physicists have strong evidence that the universe began at such a high temperature that nothing like life, sign vehicles, or even atoms could have existed. Sign vehicles could not “come out” of this universe until it was cool enough to form stable material structures like molecules. Now, if your metaphysical principle simply asserts that the Big Bang included high-temperature *signs*, or what Peirce calls a “chaos of unpersonalized feeling” that does not address this empirical evidence; nor does it address the origin of life problem – or why these signs that Peirce says are “acting always and everywhere” have only rarely and locally produced life.

Physicists can understand why specific organizations of *molecules can function as symbols* that instruct replication. But from our theories of physics, it is not possible to even imagine how *symbols can become molecules*. In other words, unless Hoffmeyer can explain how *signs can act as matter* before there is even matter

to act as signs, his “irreducible ontological category of signs” returns us to Descartes’ ontological dualism.

I agree with Hoffmeyer that modern science, and physics in particular, is severely limited in what it can say about life, language, and human behavior. Physical laws were never created to explain life, and as I have argued at length (e.g., Pattee 2007), they cannot do so. However, that insufficiency is not an adequate reason to reject the entire metaphysics of scientific objectivity that requires an epistemic cut. From the scientific point of view, this cut is not a paradox. It is necessary, rather, in order to distinguish initial conditions from laws, symbols from matter, and the living from the lifeless.

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EVOLUTION

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First, the bird must anticipate that the fox will chase it if it moves awkwardly. This anticipation may be based on learning, in which case it would come close to 'interpretation' as the word is used in the human context. Or the apparent anticipation is in fact just an instinctive behavior pattern – in which case we are still justified in saying that the evolutionary process has somehow made an anticipation, in the sense that it has managed to genetically instantiate a general rule concerning the chasing behavior of predators in the bird – a rule based on the outcome of myriad individual cases. But to make a general rule out of single cases logically seems to come close to what interpretation actually means. Accordingly, I suggest the term evolutionary interpretation to cover such cases.¹

It is hard to conceive of a better homage to a thinker than offering a reflection that takes his thought seriously, and as a springboard to further thinking. Those who render such homage in these pages will probably address some of the pivotal ideas that Jesper Hoffmeyer has bestowed on biosemiotics, e.g. code duality, semiotic freedom, semiotic scaffolding, etc. Yet I find myself incapable of engaging any of such ponderous topics in just a few lines. I will instead try to tackle a short, undeveloped remark in the epigraph's quotation: *But to make a general rule out of single cases logically seems to come close to what interpretation actually means*. This provides fodder for some Peircean musings.

¹ Hoffmeyer, Jesper 2010. A biosemiotic approach to the question of meaning. *Zygon* 45(2): 367–390 (p. 372).

In previous work, Jesper's story of a bird that fakes injury to save her nest served to introduce the idea of "semethic interaction" (Hoffmeyer 2008: 189). Here he uses it to bring together two basic semiotic conceptions: *interpretation* and *generalization*. I will attempt to further articulate their togetherness.

Interpretation: In biosemiotics – in contrast to anthropo-semiotics – the term '*interpretation*', in my opinion, should not refer to an agent's subjective action. Instead, it should refer to the exertion of that peculiar kind of action (semiosis) that the sign itself performs to generate an interpretant. This interpretant usually becomes embodied as the first link of a chain of ordinary physical actions. For instance, a signaling molecule binds to a receptor in a bacterium's membrane and thereby activates the transcription of a gene. The interpretation is determined by a form (here, a conditional disposition to act in a certain general way) that the sign transmits from its object to the interpretant.

Generalization: Following Peirce's intimations, we can think of '*generalization*' as mediating the world of signs and the world of physical processes. Just as logical inference may be seen as an analogue of physical causation, conceptual and theoretical generalization may be regarded as analogues of cosmic and biological evolution. Generalization can be seen as the growth of signs, and biological evolution as the generalization of living forms. Both generalization and evolution compel the emergence of novel laws and structures that continuously grow in variety, as well as in both the number and the complexity of their unifying relations. Both, too, retain previous novelties as special, limit cases of their more developed forms.

Interpretation as generalization: From this perspective, Jesper's *evolutionary interpretation* names a primitive, inchoate form of generalization, latent in the formation of any interpretant. Most signs are proto-symbols, which are rudimentary concepts. Concepts are incipient propositions, and these in turn are underdeveloped argumentations. Aided by models and experiments, argumentations may mature into full-fledged theories. All this has its earliest root in the translation of the immediate object of a sign into an interpretant that instantiates an inherited behavior pattern.

Indeed, this very text is an example of such logic. And while Jesper may or may not agree with this '*generalization*' of his remark,

I trust he will accept it as a modest tribute of affection and admiration.

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EXHIBITION

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*There is more to the world than matter and energy. There are also surfaces and signs.*¹

One of Jesper Hoffmeyer's tasks in the making of our exhibition *Signs of Life*, held at the Esbjerg Museum of Art in Denmark in 2011, was to make five brief statements that summed up five core elements in his theories of biosemiotics.

The exhibition was going to take place in a museum of modern art, and it was our intention to make the museum into an artwork in itself. We did not so much want to "illustrate the ideas" for the audience, but to make a sort of *open image* or *code* that could be interpreted by the audience from their own points of view, and hopefully to inspire the spectator think about science, biology and art in new ways.

So the task for Jesper was not just to make an explanation of his theoretical ideas, but, in a few words, to paint a mental picture which in the museum would work as an artwork in itself. This was probably the one element in our whole project I was most anxious about. But, of course, Jesper showed his mastership of language and his perfect overview of the subject matter, and produced five absolutely clear, condensed and poetic texts.

¹ Hoffmeyer, Jesper 2011. The depths of the surface. In: Skriver, Morten; Kjeldgaard, Inge Merete (eds.), *Livstegn. Kunst + biologi. Morten Skriver og Jesper Hoffmeyer*. (Katalog.) Esbjerg: Esbjerg Kunstmuseum, p. 81.



Figure 1. *The Depth of the Surface*: Installation view, Morten Skriver/Jesper Hoffmeyer 2011.

My favorite of these texts is called *The Depth of the Surface*. Maybe this is because this concept was so new to me when Jesper presented it during our planning, but more probably because it also relates so

very much to my own work with art, and to life in general. There is something profoundly revealing and true that comes into view when you look at life's central elements as "surfaces" that, on all levels of existence, both divide and unite. In fact, Jesper starts this particular text by stating that: "The most wonderfully strange aspect of life may be that it has an interior part that exists because it is defined through its contrast to the exterior".

Moreover, I believe that this section of the exhibition was the most successful, because it attained a complete coherence between content and form, as a video installation where the different images were projected onto semitransparent surfaces that were hanging free in the space. It was a room where you did not have to understand anything with your mind, but could sense the message with your whole body. Precisely the way that Jesper (and most artists) understand that we are perceiving the world most of the time, anyway.

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FALLIBILISM

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*Like Peirce, I prefer a philosophy which enables one to comprehend the world as a place where spontaneity is not rejected out of hand and where one can therefore entertain the thought that something radically new – i.e., essentially unpredictable – might be generated. A philosophy that has not already barricaded itself against the path to insight embodied by the question, why on Earth should they have been here all the time?*¹

Science is to mean for us a mode of Life whose single animating purpose is to find out the real truth (Charles S. Peirce; c. 1902, CP 7.54).

In the 1970s, Jesper Hoffmeyer did experimental research within the field of biochemistry. Later, he gradually turned to theoretical biology (Cobley, Deely, Kull, Petrilli 2011: 509). Concerning the latter, we find the above quote in Hoffmeyer's excellent monograph *Signs of Meaning in the Universe* (1996: 27).

The philosophy, or rather the scientific metaphysics, of C. S. Peirce (1839–1914) plays an important part in the framework of Hoffmeyer's great and groundbreaking thinking concerning questions of theoretical biology. Peirce was arguing against *necessitarianism*, or mechanical philosophy (CP 6.38), according to which everything in the universe is determined by law (CP 6.36). Peirce, among other things, analyzed the logic of scientific reasoning – e.g., the justification of valid induction – and looked upon the facts of scientific practice from the laboratories and the fieldwork (e.g. the

¹ Hoffmeyer, Jesper 1996. *Signs of Meaning in the Universe*. (Haveland, Barbara J., trans.) Bloomington: Indiana University Press, p. 27.

making of observations and measurements). Yet there he could not find the slightest evidence for the postulate of determinism.

Instead, Peirce developed his doctrine of *tychism* (from the Greek *tyché*, meaning ‘chance’), insisting on a real and irreducible element of pure chance in the universe, a spontaneous deviation from the laws of nature. Peirce saw the imperfect observance of law (CP: 6.46) and the variety of forms which exist in the universe as important evidence for the chance-hypothesis (CP: 6.53). However, according to Peirce, all variations and diversifications are united ontologically, since there is also a tendency toward order in the universe, a ‘becoming instinct’ tending toward general habits (and later, general ideas) — and this a key principle of his *synechism* (Fisch 1986: 5).

Revealingly, Peirce wrote the following in the article ‘Pragmatic and Pragmatism’, again from *Baldwin’s Dictionary of Philosophy and Psychology* (1902):

“Synechism [...] is founded on the notion that the coalescence, the becoming continuous, the becoming governed by laws, the becoming instinct with general ideas, are but phases of one and the same process of the growth of reasonableness.” (CP: 5.4)

Hence, Peirce believed that the universe shows a real tendency to become more law-like and progressively more knowable. Thus, in the evolution of the universe two real tendencies can be observed: a habit-taking tendency, but also an increase of variety. Peirce regarded evolution as being growth, and more specifically a growth in both the number of uniformities and the number of varieties. This is the law of ‘laws’, claims, Peirce, no more and no less (CP: 6.91).

Inspired by the above-mentioned points concerning Peirce’s doctrine of tychism, Hoffmeyer writes the following in his lucid article ‘Order out of indeterminacy’: “Only by claiming that indeterminacy is primary will it be possible to explain the ‘diversification of nature’, because anybody can see without any algebraic apparatus that mechanical law out of like antecedents can only produce like consequents” (Hoffmeyer 1999: 326). However, if reality itself is marked by an increase of both variety and chance, or if spontaneity is really effective in the universe, what would the experimental biologist Hoffmeyer say are the consequences for biology as a science?

Let us try and make a guess. He would probably say that these consequences must be manifold. And maybe he would mention at least the following: In biology, we should find an insistence on the inherent fallibilism of the inquiry; the process of biological inquiry will always be ongoing, since the inquirer and the community of which he is a member are fallible. As Peirce wrote in an untitled manuscript (c.1897): “[...] fallibilism is the doctrine that our knowledge is never absolute but always swims, as it were, in a continuum of uncertainty and of indeterminacy” (CP 1.171).

Maybe Hoffmeyer as a Peircean-inspired theorist would also point to the limitations of the cognitive apparatus of the biologist: he or she has no infallible intuition; and, furthermore, the weakness of his or her cognitive methods – concerning error in measurements, uncertainty introduced by inductive reasoning; and, finally, not to forget, the limitations in the content of his or her knowledge – exactly points to the fact of indeterminism and spontaneity.

Peirce advocated a thoroughgoing evolutionism; hence, the entire universe is permeated with evolution and its processes, and everything in the universe should be understood as an evolutionary product. In this perspective, biology as a science, Hoffmeyer would probably say, is shooting at a target that is always moving; he himself being – as was Peirce – a fallibilist in the search of truth.

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FITNESS

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The evolutionarily relevant fitness concept, semiotic fitness, should ideally measure the semiotic competence or success of natural systems in managing the genotype-environment translation processes.¹

The concept of fitness as it is used in evolutionary biology carries with it a strong flavour of sociomorphing modelling. Every facet and quality of an organism is transposed to one absolute and quantitative measure of success: the number of viable offspring. Jesper Hoffmeyer makes an attempt to domesticate the fitness concept in semiotics by introducing the term *semiotic fitness*, which is defined as the measure of success of an organism in interpreting information, using its biological inheritance for doing so, and in relation to the given ecological context. With this new perspective, the center of activity has clearly shifted – for while in classical evolutionary biology, an organism remains the passive object of selection pressures, in Hoffmeyer's interpretation, 'life' becomes the centre of active interpretation and translation. This shift makes the concept of *semiotic fitness* harbour a certain affinity with James Mark Baldwin's (1896) concept of *organic selection* or F. John Odling-Smee's (1998) concept of *niche construction*.

Perhaps the most puzzling and intriguing aspect in the citation above, however, is the use of the word *translation* in this particular context. Hoffmeyer develops this line of thought further in his essay 'Origin of species by natural translation' where he specifies the concept of natural translation as referring to "any process whereby a

¹ Hoffmeyer, Jesper 1997. Biosemiotics: Towards a new synthesis in biology. *European Journal for Semiotic Studies* 9(2): 355–376 (p. 370).

potential message is made accessible to a natural system that would not otherwise be capable of making sense of this message” (Hoffmeyer 2003: 335). In more traditional usage, however, ‘translation’ is considered to take place between two languages, codes or repertoires. Thus, the blending of genetic and environmental information in the translation concept that Hoffmeyer offers may lead one to wonder: “What exactly is translated into what?” Is it the organism’s genetic information that is translated into the code of the environmental context? Is the organism’s phenotype a result of this translation? Perhaps we can receive some help from the ideas of Juri M. Lotman, who has noted, in the context of cultural semiotics, that when two different semiotic systems start communicating, they tend to establish a common semiotic ‘personality’ and emergent new dynamics on a higher structural level of the system (Lotman 1992: 114–115).

In the biological realm, this ‘new level’ could be described as the lived expression of an organism in its environment, manifested in meaningful adaptations and correspondences, communicative interactions and behaviours (this would include, for instance, colourful mimicry adaptations, interspecific alarm calls, and many other examples belonging to the category of *semiotic interactions* in Hoffmeyer’s (2008: 189) terminology). Consequently, ‘semiotic fitness’ could be expressed as the significance of the organism’s lived expressions in the ecosystem, as its success in triggering new semiotic activities and processes, or at least its potential to do so.

Paradoxically, if ‘semiotic fitness’ is understood to describe semiotic processes as interpretations or translations whose outcomes influence the survival of individuals and species, then *semiotic fitness* could hardly become a measure comparable to the *biological fitness* concept. This is so because semiotic processes are essentially qualitative, open to future semioses and interpretations, and their significance or value cannot be determined in any given moment. Similar to Peirce’s *final interpretant*, that can be expressed as the sum of all possible outcomes of the sign (CP 8.184, 8.314), ‘semiotic fitness’ would be expressed in all *future* semiotic processes that spring from a particular activity of an organism. If there is anything to be measured, then, it is not the success of this activity, but its failure – and therefore, perhaps, *semiotic unfitness* could be a more appropriate concept for semiotics.

Hoffmeyer, too, takes note of such restrictive aspects of the concept, when he reminds us that: “[I]f the semiotic fitness of a natural system, in the sense of a semiotically integrated dynamic unit, is low, other such semiotically integrated units will tend to capture a share of their flows of matter and energy, and ultimately such units would tend to disappear” (Hoffmeyer 2003: 343).

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FREEDOM

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*The most pronounced feature of organic evolution is not the creation of a multiplicity of amazing morphological structures, but the general expansion of 'semiotic freedom', that is to say the increase in richness or 'depth' of meaning that can be communicated.*¹

Biosemiotics studies the signification, communication, and habit formation of living processes. The change of perspective that distinguishes it from mainstream biology lies in its consideration of life not just from the standpoint of physics, chemistry and information theory, but also from the standpoint of semiotics, as dynamic meaningful sign processes and structures. As such, it attempts a more unified semiotic perspective on the processes and patterns that connect the central material phenomena of the living world – from the ribosome, genes, proteins, cells, nervous systems, perception and motor organ's stimulus-driven reflex behavior, to the conscious and experiential world of human beings and higher mammals.

The materialistic view of evolution is a view that attempts to encompass the beginnings of life in the universe, to its diversity of forms and its adaptation to material ecological aspects of reality – until central nervous systems makes the concepts of *motivation*, *experience* and *consciousness* unavoidable. To understand animal behaviour in a biological and scientific way, Konrad Lorenz, Niko Tinbergen and Karl von Frisch developed the paradigm of *ethology* in the last half of the 20th century. Ethology is the comparative study of animal behavior, and it studies the biological roots and meanings of animal actions –

¹ Hoffmeyer, Jesper 1996. *Signs of Meaning in the Universe*. (Haveland, Barbara J., trans.) Bloomington: Indiana University Press, p. 61.

which is the closest modern scientific biology has ever come to a bio-semiotic understanding of cognition, communication and behaviour.

Much like Thomas Sebeok and Jesper Hoffmeyer were, in their development of biosemiotics, Konrad Lorenz was inspired by Jakob von Uexküll's idea of a species-specific *umwelt* for every animal species. The *umwelt* is build out of those aspects of the world, which are working as sign stimuli for the animal's battery of evolved instinctive behaviours – also called its *ethogram*. But neither Jakob von Uexküll nor Konrad Lorenz had the triadic sign concepts from C. S. Peirce's pragmaticist semiotics to draw on, and only such a semiotic view is able to deal with the reality of such *signification spheres* as the centre of the dynamics of meaning leading into culture and language.

Inserting materialistic biology into Peirce's semiotics, Sebeok's and Hoffmeyer's biosemiotics looks at the semiotics of nature, such as the grounding of sign processes in the fundamental processes of the development of our universe. In so doing, it revises the metaphysics of Darwinism so as to be able to describe the emergence of cell interpenetrants in biotic evolution (through the emergence of swarm-intelligence in the inner organisation of bodies) as well as to examine how the semiotic interpenetrations of the nervous, hormonal and immune systems interact so as to produce a biological self – and to describe how this whole adapts to the changing structures and processes of the surrounding ecological system.

Mainstream mechanistic biology has only probability theory and the mathematical model of self-organization to aid it in its inquiries into how to map the dialectic process between evolution and life. Hoffmeyer's biosemiotics, instead, is an attempt to marry concepts from Gregory Bateson and Jakob von Uexküll with Peircean semiotics in order to answer questions about the biological and evolutionary emergence of qualia, perception, meaning, and intentionality as the basis of cognition, communication and the organization of living systems communities and cultures. The focus is thus on sign-functions in physical, biological and virtual universes such as the semiotics of anticipatory systems.

One of Hoffmeyer's most fruitful contributions to the development of resolving this problem of the emergence of life and meaning in the material world is his profound paradigmatic statement that it is the *sign*, rather than the *molecule*, that is the basic unit for life. By so positing, Hoffmeyer goes beyond a monistic materialism as the

foundation for the life sciences, without embarking on the ship of vitalism in a dualistic framework. The success of this move is the shift to the paradigmatic framework of the audacious triadic semiotic philosophy of Charles Sanders Peirce.

The modern synthesis of evolution – based on molecular biology, combined with a cybernetic and systems view of ecology, plus the arrow of time from thermodynamics' Second Law of entropy – refrains from giving evolution any direction other than the growing possibility of creating and sustaining more and more complex, dissipative, self-organizing structures, which then become stabilized by auto-catalytic functions. But Hoffmeyer's introduction of the sign function and its production of meaning into this picture of nature and its living systems is one of his greatest achievements, and he uses it to advance a theory of "*semiotic freedom*": a theory of non-divine/ non-spiritual *meaning* as the driving force in evolution. Yet Hoffmeyer does not equate this idea to Peirce's foundational concept of "evolutionary love", nor to Peirce's idea of the universe becoming more rational and well-ordered, because of living and human systems' intervention into the evolution of the universe.

Having known Jesper Hoffmeyer and his work for almost 35 years, it is my interpretation that his conceptualization is rather motivated by a paradigm of "freedom" that is inspired, rather, by Marx. I therefore choose this quote as one of his most important in shaping his particular brand of biosemiotics by using Peirce's paradigm to interpret the results from modern natural and social sciences through a lens of Darwinian and Marxist pragmatic paradigms, which have been superimposed unto Peirce's huge pragmatist semiotic process philosophy.

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HIERARCHY

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It should be noted that the term ['semiotic freedom'] refers to any activity that is indeed free in the sense of being underdetermined by the constraints of natural lawfulness.¹

While I'm a great fan of showing how almost any activity in biology or culture is strongly influenced by physical-chemical constraints, I have recently (Salthe, forthcoming) called myself to account on this penchant in connection with my work on compositional hierarchy theory, after considering an interesting point in the work of Andree Ehresmann and Jean-Paul Vanbremeersch (2001) on the hierarchical organization of brain activities, and one which relates directly to Jesper Hoffmeyer's notion of semiotic freedom.

It is a standard posit, one which I have not specifically until now interrogated in my own work, that a higher level (larger scale) module will constrain, regulate, or interpret a number of lower level entities included under its span. The default interpretation of this is that these lower level entities are fixed in the organization of the system, and this mechanistic view is generally how I tend to visualize this organization.

Ehresmann and Vanbremeersch have proposed, however, that a brain module will regulate a varying set of lower level entities under different conditions, leaving the composition of this set open to context. The aspect of hierarchy theory involved here is signaled by the term 'heterarchy', which is sometimes used pejoratively to denigrate the hierarchy approach. However, the removal of this

¹ Hoffmeyer, Jesper 2008. *Biosemiotics: An Examination into the Signs of Life and the Life of Signs*. Scranton: University of Scranton Press, p. 187.

idealistic simplifying constraint on subsystem membership does not alter any of the principles of compositional hierarchies. The simpler view that I had held *faut de mieux* is not an actual principle of this system, but merely a diagramming convenience that had found a cozy place in my mind.

In semiotics, recently I have been suggesting that *semiosis* is most generally the situation where a system's response to an object is modifiable according to context (Salthe, forthcoming). That is, that the context functions as sign. The Ehresmann and Vanbreemersch concept mentioned above can be seen to be a neat example of this in the world of neurons. The module selecting its components, as above, will be responding to its own dendritic survey of brain context, which would detect signals received from yet higher-level modules which constrain its own behavior. These will be affected, in turn, by signs mediating the system's encounter with its outside environment (Herrmann-Pillath, Salthe 2011).

All of this is top-down, as opposed to the usual (but really not necessary) physicochemical bottom-up image of system activities. As I noted in 1985, however, compositional hierarchies are functionally both bottom-up and top-down simultaneously. So here we have an interesting example of Jesper's 'semiotic freedom' – which can be expected to become evident when trying to use necessarily simplified models to interpret natural systems.

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INDIVIDUATION

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*The outline that we have given in this chapter of life's beginnings [...] describes a process of individuation, especially if the word is understood in its broader philosophical meaning as a process through which an individual form of existence develops itself from the basis of the general continuum.*¹

The work of Jesper Hoffmeyer contributes significantly to the definition of a common theoretical grounding capable of encompassing and explaining the distinct forms of semiosis, as instantiated by different types of cognition. In this common essential epistemological framework, the concept of *individuation* plays a fundamental role.

A life form and its environment constitute a unit – a microcosm grounded on a privileged dialectic relationship. Jakob von Uexküll, in *Umwelt und Innenwelt der Tiere* (1909: 41) refers to this unit as a closed purposive organisation. According to him, every animal carries its surrounding world with it during its entire lifetime, like an impenetrable shell. This dialectic relationship is not only responsible for the process through which an individual form of existence develops itself from the basis of the general continuum, but also for the definition of a particular view of the world. In this specific ‘world model’ – i.e., the organism’s *umwelt* – particular environmental features are individuated and consequently assigned specific meanings.

¹ Hoffmeyer, Jesper 2008. *Biosemiotics: An Examination into the Signs of Life and the Life of Signs*. Scranton: University of Scranton Press, p. 37.

As I have posited in my own work (Ferreira 2010, 2011), *meaning* is always a value-structured entity, independent of the type of cognition or the level of semiotic complexity involved. Such *value* is assigned by the cognitive agent to an individuated environmental feature (or to a cluster of features) that, because of the agent's physical nature, emerge in the environment as salient. Gibson (1986:127), calls these environmental features "affordances" – the potentialities present in the surrounding environment to satisfy an organism's specific needs. For instance, the presence of a certain flower affords a small insect the possibility to rest, and to drink some of its nectar, while the same flower affords a bird the chance to satisfy its hunger by eating insects. It is thus the organism's sensitivity to specific features that allows for their individuation and consequent recognition in the surrounding environment.

As Cassirer (1996: 83) points out, such "seeability" is neither a predicate attributed to things as such (as 'absolute' things) – nor does it consist in the simple passive possession of certain sense-data, optical sensations or perceptions. It is, in fact, and just as Hoffmeyer has consistently asserted, the result of an active process of *interpretation* that is undertaken by an entity endowed by evolution with a specific physical architecture.

The capacity to individuate and to identify specific environmental features arises naturally whenever the organism interacts with its environment, and is defined by species-specific semiotic relations. This disposition seems to rest upon a significant degree of innate "knowledge" – a "know how", which all organisms possess – and which is the result of the experience of their biological predecessors, and a consequence of their adaptive efforts to adequately respond to environmental conditions and changes. Based on the recurring properties of previous encounters, these architectures *embody* vital information concerning the typical environmental patterns the organism will have to face, guaranteeing this way the "know how" that guides all its actual interactions.

Human cognition incorporates not just an organisms' capacity to cope with specific physical environments, however, but also its capacity to evolve in dynamically differentiated social, cultural and linguistic contexts, constructing specific world views. These 'world views' are the result of the kind of complex semiosis that characterises human cognition. It is this complex semiosis that is responsible

for the production of all systems of perfectly individuated values that, in turn, give body to specific social and cultural frameworks. Here individuation, salience and meaningfulness are defined according to particular historical, cultural and linguistic backgrounds, and are consolidated or redefined by recurrent individual and collective interactions.

The incorporation of these systems of values allows the individual to elaborate a model of his environment and to situate himself in it. Simultaneously, this progressive incorporation contributes to the definition of the Self, shaping the individual's identity by defining his role and place in the community.

Though acknowledging that the social, cognitive and emotional processes of humanity cannot simply be understood as individual manifestations of biological phenomena, Hoffmeyer goes a step further: highlighting the existence of a common reality that binds 'the natural' and 'the human' – in his words, "a causally efficacious matrix of biological interaction, the utterly natural product of organism's interaction: the semiosphere" (2008: 8). In short, Jesper Hoffmeyer's work on biosemiotics alerts us to the complexity and beauty of semiosis, the complexity and beauty of life itself in all its spheres.

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INFORMATION

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*That an age which is exceedingly preoccupied with handling of the informational aspects of the world should reinterpret nature in informational terms is of course hardly a surprising thesis. But when it becomes understood that information without subjects is a fiction, this thesis will change the whole of science.*¹

I would argue that the development of science in the last decades of the 20th century was shaped more by the concept of “information” than by any other technical concept or discovery. And yet the version of this concept that has played this central organizing role, as Jesper Hoffmeyer has long been arguing, is curiously hollow, eviscerated of the functional role it pretends to play. Indeed, it is nearly unrecognizable in comparison to both the colloquial version of this concept and its historical antecedents. But even more curious is the fact that its centrality to so many fields of inquiry – and its attractiveness for uses in fields as diverse as biology, cognitive science, and even quantum physics – derives from feigning to provide this excluded conceptual content. As a result, the term “information” has become a Trojan horse, enabling a radical form of eliminative materialism to become the presumed established dogma in science, while pretending to offer a false consilience between the physical and the semiotic realms of inquiry.

¹ Hoffmeyer, Jesper 1993. The Changing Concept of Information in the Study of Life. Paper Prepared for the Symposium *Nature and Culture in the Development of Knowledge. A Quest for Missing Links* Uppsala, 8–11 September 1993. (<http://www.molbio.ku.dk/MolBioPages/abk/PersonalPages/Jesper/History.html>)

The now dominant technical conception of “information” can be traced to a widely heralded technical report by the Bell Labs scientist Claude Shannon that was originally released in 1948 and titled “The Mathematical Theory of Communication” (Shannon, Weaver 1948). Though at the time overshadowed by the discovery of the transistor, this theoretical paper has changed the sciences as much as that electronic innovation has changed the world of computation. Most refer to this paper as the founding document of the field often described as *Information Theory*. But Shannon's use of the term “communication” in the title, rather than “information”, was no accident. Attending to this apparently subtle difference in word choice offers an important clue to the critical shortcomings hinted at in the quotation from Hoffmeyer that is cited above.

This is because “information” in this narrow, technical sense has almost nothing to do with *informing*. It is defined instead as a property of a sign *medium*, irrespective of what its message is about, or whether its ‘content’ is significant. Thus, the information bearing capacity of a given medium (e.g. a collection of alphanumeric characters) is measured in terms of its potential combinatorial variety (which Shannon called its *entropy* – and which is calculated analogously to thermodynamic entropy), and the information conveyed by a given signal or message is measured in terms of the quantity of uncertainty removed, compared to what could have been received.

It's not that this conceptualization is an outright error – indeed, it was necessary for its use in measuring such things as data storage capacity or the bandwidth of internet connections. Yet, it provides a false sense that a more problematic challenge has also been met. As Hoffmeyer has repeatedly stressed, living processes are intrinsically semiotic – i.e. they are organized in such a way that they interpret certain molecular relationships as being *about* other attributes of the world and about other cellular molecular relationships. For this reason, a conception of *information* that fails to address this referential relationship is inadequate for biology, much less cognitive science. A theory of information that explains neither its ‘aboutness’ nor what constitutes an interpreter (i.e. a “subject”) ignores what is most in need of explanation.

Early in the 1940s the brilliant quantum physicists Erwin Schrödinger delivered a series of lectures that formed the basis for a

book entitled *What is Life* (Schrödinger 1944) that offered two fundamentally linked insights: first, that living organisms must somehow persistently work against the spontaneous increase in entropy; and second, that critical to this, they must maintain and transmit information stored in molecular form (hypothesizing a molecule which he presciently described as an aperiodic crystal). Although both insights went on to characterize work at the forefront of biophysics and molecular genetics, respectively, in the more than half century that has followed, little effort has been dedicated to the obvious interdependence between these two unprecedented features of life.

Both attributes have nevertheless played a role in the development of complexity theories and dynamical systems theories during this epoch. And yet these theories also assume a conception of information that is essentially equivalent to the content-less conception originally described by Shannon. In fact, although most researchers who promote a dynamical systems theory of brain function and cognition are critical of computational theories of mind, they also treat the concept of mental representation as a fiction (e.g., Freeman, Skarda 1992; Garzón 2008). This is ultimately an anti-semiotic vision, though often this fundamental incompatibility is ignored. In this respect, such thinking tacitly reifies the Cartesian incompatibility between mind and mechanism, and presumes that the former is illusory.

Biosemitotics, as Jesper Hoffmeyer has developed it throughout his career, takes as its most fundamental assumption the view that life is at base a representation-using process – indeed, the ultimate ground of all such processes. In this respect, the origin of life is the origin of semiosis. From this perspective, until we develop a concept of organism that is not merely a dynamical system – but also constitutes a representation-creating subject – biology will remain eviscerated of its defining attribute.

Organisms are – as Stuart Kauffman has described them – autonomous agents able to act on their own behalf (Kauffman 2000). Their being able to do so, however, depends on the capability of their dynamical constitution to both embody information *about* their fundamental constitutive properties, and to utilize features of their environment as information *about* its suitability to support or disturb this self-constitution process. Organism self and conscious subjec-

tive self are thus internally constituted, and in this respect are self-referential as well (Deacon 2012). So when referentiality (*aboutness*) and subjectivity (*selfness*) are treated as fictions, the distinctions between life and lifeless and between mind and mechanism dissolve.

As Schrödinger intuited (even if he didn't explicitly claim it), the dynamical and informational features of life must ultimately be two aspects of the same dynamic. So it is this apparent "incompatibility" that must be the fiction. As Hoffmeyer predicts, only when the merely quantitative conception of information is shown to be the real fiction, and a semiotic conception of information takes its place, will the sciences be capable of explaining the nature of a universe that includes living subjects. Otherwise, science will remain trapped in the Cartesian paradox that makes it absurd that subjects like us exist.

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*Nature is, briefly, a word to be dealt with cautiously. Yes, nature is a word. Words come from the mouth, and the mouth is in the head. Hereby, we have the title and topic of the current book: How did nature enter the head? And how do we get it out of the head, when we talk and write?*¹

This paragraph appears on the opening page of what was my first encounter with Jesper. On the title page, I find the signature of an undergraduate student, bearing my name; underneath, he has written the year, 1989. ...1989. Like 1789, a revolutionary, catastrophic year. Nothing suggested that the year would become anything special, but in hindsight, there is a before and an after. It is a singular point in time, at least to a European. It was the year where I discovered – in my own body, world and mind – that the reality we live in is historical; that it may change rapidly in completely unforeseen ways; and that maybe ‘life’, in the general, always adapts, somehow; but that life, in the personal, in a very concrete way, is about getting one’s bearings under change: not only adapting, but also shaping that reality and those relations that one is embedded in.

Also, within the trajectory of Jesper’s writings, this book falls right on a watershed. Before: a series of books in Danish that places biology in a societal perspective: *Dancing around the Golden Grain: A Book on Biology and Society* (1975), *Ecological Means of Production* (1977), *Evolution, Ecology, History* (1980), and *The Natural History of Society* (1982). After: monographs, all translated into English, that investigate, and indeed establish, biosemiotics:

¹ Hoffmeyer, Jesper 1984. *Naturen i Hovedet, Om Biologisk Videnskab*. København: Rosinante, p. 9 (translation mine, A. R.).

Signs of Meaning in the Universe (1994), too many journal articles to count, and *Biosemiotics: an Examination into the Signs of Life and the Life of Signs* (2008).

Naturen i Hovedet, almost prophetically, contained elements of both periods. It begins with a story of the murder of J.R. Ewing in the television series *Dallas* – and it ends on a very early version of Code Duality. Reading it, in 1989, was a transforming event, critical in nudging that path, which became my life and career, in a novel direction. It was also a confusing experience, and I think I may now see why. The book rides two horses, almost simultaneously. In the opening paragraph above, it places nature in us, and us in nature, and all of that in time, following up on the earlier writings. It ends with some disturbing considerations on chickens and eggs, on codes, the analogue and the digital, and on how, somehow, ‘meaning’ emerges. These last observations point directly to Hoffmeyer the biosemiotician.

Rereading the book, in 2012, is not a smooth ride, and finding a suitable quote not easy. Each sentence seems either fraught with uncertainty, or with too much certainty on positions that seem difficult to uphold today. However, it was this fragile, daring, poetic, imaginative, and very *insistent* attempt at doing the impossible that made the book a revolutionary, transforming reading to a perplexed, confused undergraduate.

Perhaps this tension between the semiotical and the societal – evident in *Naturen i Hovedet* and still fundamentally unsolved – is worth revisiting; also, or maybe in particular, for those who mainly think of Jesper as a biosemiotician.

Today I will just say: Thank you Jesper, for all those fragile, daring, poetic, imaginative and insisting thoughts!

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INTERCONNECTIONS

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*The most salient characteristic of organic evolution is not the formation of an enormous diversity of morphological structures, but the general growth in 'semiotic freedom', that is the increase in richness or 'depth' of that which can be communicated.*¹

The book of nature, according to Jesper Hoffmeyer, can be read in more or less the same way as we read a poem, a play or a literary novel. If art is defined through its redundancy of meaning, then nature is doubtless a work of art. It conveys far more information than anyone can assimilate or make meaningful use of. This is why we still write poetry, but it is also the reason why evolution is open-ended and never ending.

In his rich and diverse work, Hoffmeyer rarely makes use of examples from culture and society. He might well have done so. In fact, one of his most important contributions to knowledge consists in showing that the rules and laws, inclinations and volitions that make a difference to a crayfish or a sabre-tooth tiger are of the same kind as the underlying principles of human existence. Unlike many natural scientists, Hoffmeyer works from the assumption that significance is everywhere and that signification is the main activity of all organisms. While the anthropologist Clifford Geertz sees culture as 'a web of significance' spun by human beings, Hoffmeyer sees nature as a network of networks upheld by significance spun, consciously or not, by every participating organism. There is

¹ Hoffmeyer, Jesper 1993. *En snegl på vejen: Betydningens naturhistorie*. [A snail on the path: The natural history of significance.] Copenhagen: Rosinante, p. 23.

grandeur, as Darwin said, in this view of life; but Hoffmeyer also offers a key for transcending unfruitful dualisms and epistemological dead ends. The world is between, not within; it is becoming rather than being. The present is merely a hinge connecting a deep past to an open future.

Hoffmeyer walks his talk. Like the organisms he describes, his intellectual power unfolds in ongoing dialogue with a broad range of other thinkers, ranging from Victorians like Darwin and Peirce to close predecessors like Bateson and Maturana and contemporary chums such as the leading Danish intellectuals Fredrik Stjernfelt and Tor Nørretranders. Just as nature unfolds, and each species or organism comes into its own, through reciprocal signification with others, so does the uniqueness of Hoffmeyer's work and vision come across most brilliantly through his sympathetic discussions and disagreements with others. His is an ecological approach to everything which transcends dualisms and academic boundaries, a vision for the coming century.

In this world, we human beings have special responsibilities, and this is not just because we possess, and make use of, not only weapons of mass destruction but also weapons of mass enlightenment and confusion, from satellite television to the mobile telephone, but because of our superior semiotic freedom. While the semiotic freedom of a snake is limited by its sensory apparatus – it stops chasing a mouse when it can no longer sense it – a dog will be aware of the mouse's existence even when the mouse is hiding in a heap of rotten leaves. A human, furthermore, will not only know of the mouse, but will also be capable of predicting the future growth of rodent populations. The difference is one of degree, but it makes a hell of a lot of difference. If evolution consists in the growth in semiotic freedom (a stimulating way of talking about complexity), then we, *Homo sapiens*, for the time being placed at the pinnacle of this process, are the only species capable of reducing the amount of semiotic freedom in the world, and we are well on our way to doing so. Only we can counteract the loss of flexibility created by ourselves, and biosemiotics can help us to see both the problems and the solutions more clearly.

INTERDISCIPLINARITY

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Biosemiotics is the name of an interdisciplinary scientific project that is based on the recognition that life is fundamentally grounded in semiotic processes.

In the following passages, I intend to make a few annotations on the nature of the interdisciplinarity character that is claimed for biosemiotics in the above quote from Jesper Hoffmeyer. Interdisciplinary scholar J. T. Klein (1990: 43) explains that interdisciplinarity refers to *integration*, or the practice of *borrowing* from other disciplines. Following this definition, Hoffmeyer's remark on the interdisciplinarity of biosemiotics appears to refer to the way in which this type of biology borrows concepts from semiotics. But there are two problems with this conception: (1) it does not specify which 'version' of semiotics is being borrowed, (2) it fails to recognize that biosemiotics also borrows from cybernetics and systems thinking.

As John Deely has shown, the community of semioticians that formed in 20th century owes its birth to Ferdinand de Saussure's *semiology*. However, the coinage of the term *semiotics*, the term used in biosemiotics today, does not derive from the work of Saussure, but from the work of Tartu semiotician Juri Lotman (Deely 2010: 17). Lotman was inspired by Saussure's idea of synchrony, yet "departed from Saussure in his choice of name for the new science [*semiotics* instead of *semiology*] by reason of a more informed historicity" (Deely 2010: 17). In fact, it is Lotman's

¹ Hoffmeyer, Jesper 2008. *Biosemiotics: an Examination into the Signs of Life and the Life of Signs*. Scranton: Scranton University Press, p. 3.

historical model of culture, i.e., the *semiosphere* (1967), that has been borrowed from semiotics and integrated in biosemiotics through Hoffmeyer (1996: 59), Kull (1998) and Brier (2007: 392), among others, and not Saussure's ahistorical view of language. Thus, to tackle problem (1): biosemiotics can be said to borrow mainly from Tartu semiotics rather than from Saussurean semiology. To tackle problem (2): it is important to underline the influences of Lotman's work, in that these constitute also the 'interdisciplinary' influences of biosemiotics. These consist in his conceptualisation of both *history* and *transdisciplinarity*.

The historical character of Lotman's semiosphere has a double derivation: Russian poetics and systems thinking. Russian scholars Jakobson and Tynjanov (1929) declared that "pure synchronism [systemicity] is an illusion. Every system has past and future as structural elements of the system" (2003 [1929]: 79). In other words, they claimed that a sound understanding of 'systems' (poetic systems in their case) requires both a synchronic *and* a diachronic level. It is fair to note that Lotman drew his historical conception of systems not just from Russian poetics but also from systems thinking, as elicited in the work on irreversible thermodynamics by Prigogine and Stengers (Winner 2002: 426). Lotman underlines how "[Prigogine and Stenger's] work shed light on the general theory of dynamic processes and can fruitfully be applied to the study of history" (Lotman 2001: 232). In fact, Prigogine's work contains the passage "from a *geometrical* view of the universe [...] to a *narrative* expression of the universe [...] from *being* to *becoming*" (Prigogine 2000: 833). Arguably inspired by irreversible thermodynamics' concept of history, Lotman conceives the semiosphere as system continuously organised through dialogue (Lotman 2001: 142) – and thus as a system inevitably described through the arrow of time. Thus, by admitting both synchrony (systemicity) and diachrony (historicity) as legitimate, intertwining parameters of systems analysis, Lotman caused a break from the a-historical structural tradition in semiology (which is instead characterised by a 'pure' synchronic conception of systems analysis). Synchrony plus diachrony, or Lotman's 'historical' understanding of systems, has been extensively and productively borrowed by biosemiotics: evidence can be found in Hoffmeyer's work on *code duality* (2008); in Sebeok's work on the *phylogeny of communications* (1988), and

in Anderson and Merrell's modelling of *micro and macro evolution* of living systems (1991).

An equally important feature that has been imported into biosemiotics through Lotman's work is that of *transdisciplinarity*. This specific character, which pertains to the Tartu–Moscow school as a whole (see Randviir 2007), can be argued to derive from early work in cybernetics. 1940s Soviet academia, the environment in which Lotman pursued his studies in Russian literature, was strongly theory-oriented and was irritated by “the state's and the Party's infringements on the personal and corporate autonomy of academics” (Waldstein 2008: 17). Because of its closeness to the mathematical sciences, cybernetics appealed to Soviet scholars as an ‘ideology-free’ language and as a successful model of applicability or *trans-disciplinarity* – a character that was assimilated into the ‘Soviet Semiotics’ project (as in Lucid 1977) and ‘imported’ to Tartu through Lotman. Cybernetics was, in fact, conceived by Wiener (1951) as a meta-language capable of encompassing properties common to animal and machine – a view that has endured through the work of Ashby (1956), Bertalanffy (1968), Pask (1961), Beer (1959), Lovelock (1979), and to a certain extent (mainly through the concept of feedback), Bateson (1972), Maturana and Varela (1980), and Luhmann (1991). Therefore, in light of its versatility or ‘universality’, cybernetics is said to have favoured in Soviet academia the birth of semiotics as a science aimed at the study of “any sign system in human society” (Ivanov 1962: 3 cited in Waldstein 2008: 20). This recognition is important because: (a) it shows how cybernetics is, to an extent, the precursor of that version of semiotics that is currently, though largely implicitly, operative in biosemiotics, (b) it constitutes the basis of biosemiotics’ potential for transdisciplinarity: e.g., its impetus towards the study of biological systems in terms of semiotics, or the study of cultural systems in terms of biology.

Hence, it should now be clear how the nature of biosemiotics’ interdisciplinarity consists in more than just the integration of biology with an unspecified version of semiotics. The biosemiotic project, in fact, borrows at least as much from the transdisciplinary project of Tartu–Moscow semiotics (through Lotman) and from those enterprises that influenced it, such as Russian poetics, systems thinking/irreversible thermodynamics, and early cybernetics. This

means that, going back to Hoffmeyer's quote, biosemiotics can be considered as an interdisciplinary project, yet in light of its variegated ancestry it can also be considered as a project with great potential for transdisciplinarity – a recognition is anticipated, but not yet fully developed, in Sebeok and Danesi's *Modelling Systems Theory* (2000).

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INTERPRETANTS

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*In the biological world, certainly, signs incite the generation of interpretants in the form of actions which are future-oriented, inasmuch as living beings always seek signs for survival and for reproduction.*¹

Jesper Hoffmeyer's work is so rich, it is difficult to comment on bits in isolation. I believe, however, that I have a few words that might help to illuminate the quote above. Hoffmeyer (2008) takes a distinctly Peircean approach to semiotics both for *exosemiotics* and *endosemiotics*, so one must assume that he feels that the basic principles are much the same. Indeed, he points out that the distinction between *exo-* and *endo-* in biology is not clear-cut (2008: 213ff). His view is in contrast to well-known arguments by Marcello Barbieri (e.g., 2008, 2009) that the two differ significantly, with endosemiotics being fully satisfied by codes, while exosemiotics requires interpretation. Codes do not have, in any obvious way, a requirement for a Peircean interpretant (Collier 2008a: 778ff). I therefore believe that Hoffmeyer has it right.

However, I think the differences between Hoffmeyer's and Barbieri's views can become obscured when we look primarily at the details of individual signs and sign systems. Peirce's semiotics, however, allows for *systems of signs* in which one sign can serve as an icon for another sign, which then gives a further interpretant. In principle, this allows for a hierarchical network of signs, with interpretation becoming more general as we move upwards.

¹ Hoffmeyer, Jesper 2008. *Biosemitics: An Examination into the Signs of Life and the Life of Signs*. Scranton: University of Scranton Press, p. 65.

To be more specific: a Peircean sign is an indecomposable triad of icon, object and interpretant. The icon is the “bare feel”, or presentation; the object is selected indexically, and the interpretant brings them together in a unified context. This triad can then form the *presentation* for a further triad that is more general, if not more abstract. There is no reason why several signs together cannot provide the presentation for a more general sign. It does seem, however, that this regress (or perhaps “recursion” would be a better term) must come to an end somewhere in some most general sign, with its interpretant being ultimate.

This raises the question of ‘ultimate interpretants’ in biology – and I will try to illustrate with a couple of simple examples how looking at biological signs in this hierarchical way can illuminate the opening quote. Suppose we have smell A (icon) of something dangerous (interpretant), then it is incumbent to avoid (object). For good biological reasons, this sort of interpretation for immediate action uses very short chains, while chains related to long-term survival are typically longer. Here, then, is a slightly longer chain: Suppose we have smell B (icon) that indicates food (interpretant) that can be eaten (object). This itself is a sign (icon) that falls under survival (interpretant) indicating it should be accepted (object). Typically there will be longer chains both for the interpretant and, often, the icon. In particular, there will be many molecular and cellular processes in the two cases described that I have suppressed in these examples. These processes will also have semiotic properties, and these, too, can be integrated into the respective chains.

Is survival just an accidental property of these cases, or is there something more general going on? I think the latter. Biological organisms are autonomous, and their functional components are functional just because they contribute to that autonomy (Collier 2008b). The autonomy of organisms is exactly what constitutes their survival. Inasmuch as biosemiotic conditions are functional, and I think that they must be, then they will also contribute to survival (and reproduction). I suppose that there could be biosemiotic conditions that don’t contribute to survival, but they are very likely to be weeded out by evolution, so they would be rare and temporary at best.

I think, then, that it is safe to say that biological interpretants are functional, that functionality ultimately implies survival, and that

survival is the ‘ultimate interpretant’ for biological signs. ‘Future orientation’ itself is just a necessary part of functionality – and this, in turns, justifies the validity of Jesper’s opening quote.

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LANGUAGE

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(...) even the fully developed linguistic universe of expressive sounds remains internally connected to those pre-linguistic expressive forms (...)

Worded, vocal communication must have yielded an advantage upon our remote ancestors that body language could not possibly have mimed, and I tend to concur with Terry Deacon's suggestion that this advantage has to do with the unique capacity of language to carry symbolic reference.¹

The merit of Jesper Hoffmeyer's pointing out the insufficiency of physico-chemical explanation for living systems and their origin is hard to overestimate. He points out that this insufficiency manifests itself even in the face of recent, very important, developments in physical theory that concern the phenomena of self-organization and emergence. As Hoffmeyer writes: "How 'it's can possibly become 'I's is the puzzle that must be explained – and not even dynamical systems theory does yet offer a solution to this puzzle. What is missing, I would argue, is the admission of a semiotic dimension of explanation" (2008:179).

How very true. Only a living agent can uphold a continuous, adaptive relation with its environment, by increasing transmittable complexity. Yet it seems that there is one aspect in the semiotic function of living organisms that is underemphasized in Hoffmeyer's work. The lack of attention to this aspect is especially evident in the chapters on natural language: for "semiotic dimensions of explanation" concern not only the behavior of an individual

¹ Hoffmeyer, Jesper 2008. *Biosemiotics: An Examination into the Signs of Life and the Life of Signs*. Scranton: University of Scranton Press, p. 274.

in the environment, but – just as importantly – the coordination of the same species of organisms in their *joint* relation to the environment.

The ability of relatively independent individuals to form functional systems is evident in countless living forms, and the semiotic processes that allow for such functional coordination span a wide range of complexity. My argument here is that human language, too, must be seen as one such process and system. A very special one, to be sure, but preserving continuity with other modes of purposeful coordination – and this is the fact that paves the way to its naturalization. Such continuity is seen not only in the evolutionary succession of types of coordination systems, but also in the presence of the more basic forms, in coordination within the linguistic one.

Hoffmeyer, agreeing with Sheets-Johnstone, traces the origin of language to a “diversity of corporeal forms of expressions and impressions” and acknowledges the primacy of movement in its evolution and development (Hoffmeyer 2008: 275, 303–305). But one should note that in the case of our social species, the primacy of movement means the primacy of movement coordinated with others. One’s first experiences are not just moving and touching, but moving and touching in coordination with the movement of others. Archetypal corporeal-kinetic forms should thus be also understood as being social, as for the realization of many goals early in life, joint functionality is what matters.

In *Biosemiotics*, this “primacy of we” in linguistic coordination is difficult to see, as language is mostly treated as a “tool for expression and reflection” (Hoffmeyer 2008: 274). Following Deacon (1997), the main revolution language brings is posited in terms of individual cognition: it enables a new way of referring – i.e., symbolic reference, rooted in iconic and indexical semiosis. However, it seems that the ‘meaningfulness’ of a semiotic relation cannot be reduced merely to referentiality: it concerns, instead, a coupling between the self and the environment, comprising other organisms – and in language, this temporal, synergetic symmetry relation is especially evident.

Reference provision, obviously, is important – but it might be secondary to the coordinative role of language, for the synergy might be functional, might assume the form of action on the environment, but does not need to (as in phatic communication).

Rather, language allows us to engage in a participatory sense-making process (De Jaegher, Di Paolo 2007; Cowley 2004; Favareau 2008) in which the role of referentiality is far from obvious (Rączaszek-Leonardi, Cowley 2011). How, if at all, the ‘aboutness’ of *coordination* translates into symbolic reference remains a challenging question – and one that, just as Jesper Hoffmeyer has argued for in biology, remains in need of a truly semiotic explanation.

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LINGUISTICS

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*Scholarship is worth no more than the foundation on which it is built, and anyone who does not pay some heed, at regular intervals, to the foundations of their scholarship, is not much of a scholar.*¹

The above quote from Jesper Hoffmeyer's *Signs of Meaning in the Universe* (1996) sets high standards that very few academics can live up to. To question the foundations of biology, Hoffmeyer first turned to philosophy – and then energized the 'biosemiotic movement' to the benefit of those who are willing to test the foundations of their own disciplines for a better understanding of life as semiosis.

Hoffmeyer has just enough irreverence for what his colleague Emmeche once called *disciplinary promiscuity* – but he also has the integrity to turn such polymathism into solid arguments. Moreover, he always writes with elegance and confidence, but also with humility. And only Jesper Hoffmeyer can illustrate concepts like *semiotic causation*, *semiotic emergence*, and *semiotic scaffolding* in evolution with the movement of an *Escherichia coli* cell, a reproductive disorder in amphibians, and the development of the word 'spam' in English, respectively.

It was this perfect balance of irreverence for disciplinary boundaries and scholarly integrity that made the musings about language by a molecular biologist attractive to a linguist who sees her expertise in linguistics as just one domain of semiotics among many. Hoffmeyer tears down, again and again, the illusion of a distinction between nature and culture, the constructs of the scientific and

¹ Hoffmeyer, Jesper 1996. *Signs of Meaning in the Universe*. (Haveland, Barbara J., trans.) Bloomington: Indiana University Press, p. 131.

humanistic perspectives, and the boundaries between the institutionalized disciplines we have to live in. And, like biology, linguistics suffers from the same oppressive structures that reward the generation of academic capital, rather than addressing the big questions that have been unanswered since the 17th century and even earlier.

At a time when linguists are calling out for substantial interdisciplinary cooperation, however, Hoffmeyer's scholarship has regrettably bypassed *biolinguistics*, another movement looking for an alternative to "many currently popular models and metaphors for understanding genes, brain and language [that] need to be abandoned if [we] hope to make any substantial progress" (Fitch 2009: 286).

It is interesting that Hoffmeyer rejects Chomsky and prefers Bruner on the issue of language development. (Hoffmeyer 2008: 272) As one of the biosemiotic movement's most prolific and formidable articulators, it is an enormous loss that he rejects an intellectual movement that shares such deep foundational philosophical parallels, and whose progress depends on much of the same issues and challenges as do his own efforts in biology and bio-semiotics. (cf. Augustyn 2009)

For what distinguishes Bruner from Chomsky is the fact that Bruner conducted empirical research on mother-infant communication in order to gain a better understanding of language acquisition, while Chomsky has been promoting, for over half a century, the three factors that constitute the human language faculty as being: (1) the genetic endowment, (2) organism-environment interaction (i.e., our species-specific *umwelt*) and (3) the abstract principles that are *not* specific to the faculty of language. (e.g., Chomsky 2005) To say that Bruner has the better theory of language development, simply because he chose to study mothers and infants in their homes, is like accusing Chomsky of not focusing on what he deliberately chose *not* to focus on.

Moreover, while the empirical studies of mother-infant interaction in the homes of North American families in the early 1980s are bound to have outcomes that are relevant only for urban middle-class families in the West, the abstract principles of human language studied by biolinguists are not subject to any cultural bias because they belong to a research agenda that remains on the level of comparative psychology. To refuse to engage with what Chomsky

has focused on, because of what he has chosen *not* to focus on (even though he never disputed its importance) is like criticizing a pianist for never playing the violin.

Linguists attending the biosemiotic *Gatherings* conferences always run the risk of being perceived as naïve or uninformed about the many layers of language and communication that the inadequate abstractions in the field of linguistics cannot address. But good pianists can appreciate the violin even if they choose not to play it themselves!

Hoffmeyer should therefore be foremost among the: “linguists and biologists, along with researchers in the relevant branches of psychology and anthropology, [who] can move beyond unproductive theoretical debate to a more collaborative, empirically focused and comparative research program aimed at uncovering both shared (homologous or analogous) and unique components of the faculty of language” (Hauser *et al.* 2002: 298).

Each field needs critics like Hoffmeyer in order to evolve – while mainstream academics simply do what benefits their careers and funds their research projects by perpetuating the dominant theoretical paradigms, power structures, and methods without questioning them. Imagine the possibilities should Jesper Hoffmeyer turn his attention again to the big questions about language by exploring the foundations of biolinguistics (e.g. Jenkins 2000).

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METAPHOR

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*Biology is immature biosemiotics.*¹

First, let me start by saying that I am very happy to participate in Jesper Hoffmeyer's *tombeau*. I draw this word from the French musical lexicon, where it refers to a composition made to pay homage to an illustrious person, colleague, master or friend, alive or dead (and often alive, in fact). I am very happy to participate because I like Jesper Hoffmeyer quite a lot. In fact, he figures inside my pantheon of preferred biologists, along with Kalevi Kull, Lynn Margulis, Barbara McClintock, Roy Britten, and some other daring theorists. One particular reason why I like him so much is that he is not afraid of metaphors. Very early, he and Claus Emmeche even introduced Biosemiotics *as* a metaphor and famously stated that "metaphors may be of considerable value, not only heuristically, but in order to comprehend the irreducible nature of living organisms" (Emmeche, Hoffmeyer 1991: 1). No dismissive talk of "mere metaphor" for this biologist then; I even suspect him to adhere to the wisdom inherent in a great pun from one of his keenest influences: "A man's reach should exceed his grasp, or what's a meta for?"²

And like Hoffmeyer, I happen to like Gregory Bateson a lot, as well. In fact, it was my inspiration by Bateson that led me to travel

¹ Hoffmeyer, Jesper 2009. Biology is immature biosemiotics. In: Deely, John; Sbrocchi, Leonard G. (eds.), *Semiotics 2008: Specialization, Semiosis, Semiotics*. Ottawa: Legas, 927–942.

² Although Bateson does not claim the paternity of this statement, but rather refers to it as "the misquotation [of Robert Browning's 'Grammarians' Funeral]' that is going the rounds today" (Bateson 1991: 224).

to Copenhagen in May of 2001 for the first *Gatherings in Bio-semiotics*, which Jesper so wonderfully, modestly and humanly, hosted. For modest in person, that he is – but wonderful too, since his reach seems to attempt to grasp some of the most mindboggling issues that standard biological theory (under the guise of the molecular evolutionary synthesis) has left us with; i.e. (and due to lack of space, let me brutal): genetic information as a metaphor, the central dogma as...well, just that: a dogma. In the face of such under-theorized assumptions, the question of *information* – as well as the related questions of function, teleology and “natural intentionality” – seem to have been organizing themes, and even recurring obsessions, in Hoffmeyer’s work. And so too is the question of *semiotic freedom*.

In 1996, Hoffmeyer had already written that: “the most pronounced feature of organic evolution is [...] the general expansion of semiotic freedom, that is to say the increase in richness or ‘depth’ of meaning that can be communicated” (Hoffmeyer 1996: 61) adding an end-note that refers to a paper of his that had already made the same prescient point (Hoffmeyer 1992). He further wrote that to call this increase in richness or depth “freedom” was a difficult choice, since “freedom is [...] rather an ambiguous word” (Hoffmeyer 1996: 62). Yet in his more recent publications, this notion returns regularly, and has been progressively developed and strengthened.

In 2008, in a section entitled “A minded nature”, Hoffmeyer describes the progressive *evolution* of semiotic freedom as its propensity towards *individuation*: “In invertebrates quite generally, I assume [s]emiotic freedom is still very limited and should not be seen as property of single individuals but rather as a property of the species or the evolutionary lineage [...] at later stages of evolution, semiotic freedom becomes increasingly individualized” (Hoffmeyer 2008: 40). In other words, the individuation of semiotic freedom seems to lead to its *individualization*, once it has passed an evolutionary threshold, probably somewhere near “the much celebrated transition from a reptilian world to a mammalian and avian world” (*ibid.*).

In an even more recent contribution, Hoffmeyer again discusses semiotic freedom, this time in the more Peircean sense of “an increased capacity for responding to a variety of signs through the formation of (locally) ‘meaningful’ interpretants” (Hoffmeyer 2010:

190). The re-appearance of inverted commas around the word “meaningful”, however, might signify the return of the metaphor – and this impression is even further reinforced by a note stating that when he wrote previously that “when a bacterial cell finds itself in a gradient of nutrients and swims right instead of left, the cell is making a choice” he was “using teleological language. The idea is not, *of course*, that the bacterium makes a conscious choice” (Hoffmeyer 2010: 194). “Of course”, it seems, because according to Hoffmeyer, the individuation of semiotic freedom cannot possibly have yet reached the individualizing threshold in bacteria, and can thus be spoken of only metaphorically. And it is exactly here where I must part ways with him, in asking: *Why not?*³

If biology can indeed be considered “immature”, it might be because it appears quite often unable to control its own metaphors – which characterize probably the highest degree *semiotic freedom* has reached since life has started evolving on Earth. Biosemiotics, as Jesper Hoffmeyer has demonstrated, offers a further possible step in this evolution ... to the extent that it will discuss, improve and eventually get rid of its own metaphors, and transform them into theory and/or established facts.

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³ Actually, several contemporary biological works seem to point in this direction also: see for instance Shaviri (2011) and especially Ben Jacob *et al.* (2006).

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PROOF

NATURALISM

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*Peirce [...] claimed that the law of mind amounted to the tendency of nature to form habits. By viewing this fundamental semiosis – for a habit is the general form of an interpretant – as the innermost property of the universe, he worked out a cosmology in which the individual life and the individual consciousness appeared as evolutionary concretizations of a more general propensity of the universe. [...] Thus, the realization of Peircean cosmology in the form of modern biosemiotics becomes a lever for the repositioning of the human being as a part of nature. [...] Human mind is not, then, an alien element in the universe – but rather, an instantiation of evolutionary trends that penetrate the life sphere and that (I suspect) is deeply rooted in the general dynamics of the universe.*¹

The Peircean solution to the puzzle of the origin of individual life and consciousness in the primordial cauldron that brought forth, by evolutionary development, the universe in its entirety (including its laws), provides what might be said to be the metaphysical context for Hoffmeyer's biosemiotics – a naturalistic context that situates semiosis and life squarely in the natural world we inhabit. This is a compelling stance, which I applaud, and Hoffmeyer has devoted his distinguished career to developing this biosemiotic naturalism. He does not profess to be a cosmologist, nor, for that matter, a Peirce scholar, but at least since 1993, with the appearance of his *En snegl påvejen: Om betydningens naturhistorie*,² he has championed a Peircean cosmology as an alternative to that advanced by the prevailing

¹ Hoffmeyer, Jesper 2008. *Biosemiotics: An Examination into the Signs of Life and the Life of Signs*. Scranton: University of Scranton Press, p. 320.

² Published in English translation as *Signs of Meaning in the Universe* (1996).

deterministic science, which dismisses out of hand the idea of semiotic (i.e., final) causation, and smothers all aspirations to freedom under a blanket of unyielding natural law.

I believe the rough Peircean outline Hoffmeyer gives of the embeddedness of life and consciousness in nature is correct – and that, just as he maintains, there is a crucial link between biological life and the tendency of nature to form habits, just as there is a link between human freedom and the indeterminacy of the original chaos. But as Hoffmeyer himself points out, Peirce's cosmology is not well-understood (1996: 39–40), in part because it runs against the grain of the dominant scientific paradigm, but probably also because Peirce himself never reached a finished account. The most interesting problem from the standpoint of biosemiotics, at least as I see it, is the question of the emergence of semiosis – but there are other challenges as well. I do not suppose that a critical look at some unsettled questions about Peirce's cosmology would have any unsettling consequences for Hoffmeyer's biosemiotics, but it might bring some of both men's views into sharper focus.

According to Peirce, natural laws are products of an ongoing evolution and their emergence results from the tendency of nature to form habits. In the quotation above, Hoffmeyer identifies this natural tendency to form habits with a fundamental semiosis because, he says, “a habit is the general form of an *interpretant*” (2008: 302). This is an attractive idea, which is supported by Peirce's conception of mind as fundamentally semiotic, in conjunction with his objective idealism, the doctrine that matter is effete mind. It must be noted, too, that Peirce understood “the law of mind” to be “the law of habit taking” (Peirce 1898: 241) just as Hoffmeyer does. But, to be clear, taken together these views equate the origination of semiosis (sign action) with the origination of habit and, therefore, would seem to imply that every law is a semiotic outcome, and thus a law of mind.

How can this be reconciled with the key distinction Peirce makes between physical and mental laws – namely, that physical (at least what he calls mechanical) laws demand rigid obedience, while mental laws necessarily do not? Is the answer simply that mind evolves into matter – i.e., that mental (semiotic) law grows (or ossifies) into physical law as the underlying regularities (habits) become more and more fixed (which is to say: evolved)? Yet how could ‘mind’ function *prior* to the emergence of matter, which is

necessary for efficient causation, since, as Peirce pointed out: “law, without force to carry it out, would be a court without a sheriff; and all its dicta would be vaporings” (Peirce 1902: 92, para. 212). As a further complication, note that some biosemioticians, perhaps beginning with Thomas Sebeok, regard the emergence of semiosis to be virtually synonymous with the emergence of life. This would seem to imply that every evolved natural law is not only a law of mind, but is also a *biological* law – and that the distinction between physical-chemical habits and biological habits is moot.

Finally, can something more be said about “habit formation” beyond the claim that it is an original tendency in nature? Of course Hoffmeyer’s research has contributed a great deal to our understanding of the role of habits (and forgetfulness!) in biology, but what I have in mind is the underlying cosmological context for the grounding of biosemiotics. Frankly, I don’t have a satisfactory answer for my own question, but I am inclined to view Peirce’s neglected *agapasm*, which he sometimes described as evolution by force of habit or as evolution governed by the law of love (Peirce 1892), as a possible key to understanding his account of what Hoffmeyer calls in the quote above “the general dynamics of the universe”. Peirce’s law of love is based on a principle of attraction or sympathy that might well be fundamental for habit formation – at least at the level of cultural evolution, but perhaps also in the biological realm.

I do not raise these concerns or make these observations as objections to Hoffmeyer’s biosemiotics; I admire his work and recognize how influential he has been in bringing Peircean semiotic theory to bear on biology. But as Peirce’s still-disputed cosmology comes to be better understood,³ I would not be surprised if, through it, we learn more that is of importance for biosemiotics. Nevertheless, I am confident that the inspiration Hoffmeyer has found in Peirce has led him to a sound and profound understanding of the continuity that runs throughout nature – a continuity well expressed in the conclusion to the opening quotation: “Human mind is not, then, an alien element in the universe – but rather, an instantiation of evolutionary trends that penetrate the life sphere and that (I suspect)

³ For two recent contributions to the ongoing debate about Peirce’s cosmology, see Short (2010) and Forster (2011: Ch. 9, 10).

is deeply rooted in the general dynamics of the universe” (2008: 302).

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PROOF

OMVERDEN

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*OMverden: tidsskrift for liv og kultur*¹

Once upon a time, in a distant Queendom called Flatland – also known as Sign of Danes since the Fe Era – there lived a Gentleperson from the fen where Mendelayev overlaps with Mendel, and slides into the quicksand of Darwin. The Fe Era also manifested in the Fe Space of the Flat Periodic Table. Consequently, it was all but Ordained that this Gentleperson of Flatland, abetted by a Swarm of Conspecifics, should produce a Periodical – fat rather than flat – at the onset of the year 1990 CE.

Braiding together the Semiotic issues distinguishing, fusing, and confusing the hypothetical Two Cultures, this Periodical privileged the Tongue of Flatland, but otherwise indiscriminately drew on the Significant Ideas fueling the revolution of the Globe itself. Fresh names and genres marinated with those from the never-fully-digested Past, all arguments between Push and Pull tilting synergistically to promises of Futures. With an ear to the fens, one can still pick up the wails from those days when said Periodical succumbed to unknown causes at the end of the year 1991 CE.

The Periodical, of course, is *OMverden*, and the Gentleperson, delightfully still with us, could be none other than Shape-Shifter Jesper Hoffmeyer. In fact, the kaleidoscopic *OMverden* itself shifted shape between newspaper, magazine, and journal, even as it kept to

¹ *OMverden: tidsskrift for liv og kultur*. [The World Around Us: A Magazine for Life and Culture]. 1990–1991. (8 numbers in two volumes, commencing with April 1990 and concluding with December 1991.) Jesper Hoffmeyer, Editor. Copenhagen: Rosinante/Munksgaard.

its quarterly step. Then, even more transformations danced through the syntheses drawn from the juxtaposition of the Two-plus-or-minus-seven Cultures and even more Translated Tongues poking through the pages of *OMverden*. It is fair to claim that Shape-Shifter Hoffmeyer's touch turned inside-out and up-side-down, and then Oxidized, conventional notions of Art, Craft, and Science – to become forever Semioticized Rust, OM.

How appropriate that the prepositions probed by Viggo Brøndal for the Tongue of Flatland should include /om/, slipping from “in, around, about ...” all the way to “a sound of itself” in the Tongue of Sanskrit. And /verden/ by itself means “world”, but /omverden/ ratchets up to signify not just “around/about the world”, but more specifically “environment” – as the “Umwelt” in another not-distant tribal language.

Collective distress at *OMverden's* demise was made more acute recalling other too-brief adventures in publishing: *The Sciences* (1961–2001), organ of the New York Academy of Sciences; *CoEvolution Quarterly* (1974–1985), blossoming from Stewart Brand's *Whole Earth Catalogue* (1968–1972); and later the *Whole Earth Review* (1985–1997). Gentleperson Shape-Shifter Oxidant Hoffmeyer's *OMverden*, like other semiotic Distillations, now sweeter through nostalgia, whets rather than sates the Itching Thirst inspiring them. The Gentleperson Hoffmeyer's Itch continues to virally spiral, rippling from Flatland to the OuterSphere, addicting All to Scratch and Sniff at the ever-emerging Sign of OM.

PROOF

PANPSYCHISM

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*[...] I don't like the idea that consciousness should be present in atoms
[...] I like to see semiosis as an emergent phenomenon, where the
increase in semiotic freedom is indeed the one most conspicuous fact we
have about organic evolution.*¹

*[...] we follow Sebeok (1979) in defining the emergence of life as the
threshold for the semiosphere.*²

Here it will be proposed that in the quotations above, there is implied a discontinuity that does not exist, and a contradiction that can be resolved by adopting a form of panpsychism – and that doing so will extend the inspiring work of Jesper Hoffmeyer that has helped make biosemiotics a major scientific and philosophical project.

The contradiction is revealed by the phrase ‘emergent phenomenon’. Emergence is an idea that divides opinion. For some, it represents a light at the end of a reductive tunnel. For others, it is a promissory note that delivers little or nothing. Here it will be treated as an important conceptual tool, but not one to use as a faux explanation for something that has not really been explained.

Now, if evolution is accompanied by an increase in semiotic freedom, there must have been some there to start with, however little. To think otherwise breaks the rule, observed since the time of Parmenides, of *ex nihilo nihil fit*. That is, “nothing comes from nothing” – an ontological truism that continues to be observed in,

¹ Hoffmeyer, Jesper c.2002. Personal communication (email exchange).

² Hoffmeyer, Jesper 2008. *Biosemiotics: An Examination into the Signs of Life and the Life of Signs*, Scranton: University of Scranton Press, p. 5, fn. 3.

for example, conservation laws. Since nature is a causal continuum, to impose arbitrary discontinuities is unhelpful. As David Bohm has suggested, semiosis occurs to a greater or lesser extent at all levels of the natural and human-made world, but “greater or lesser” means a quantitative difference, not a qualitative one (see figure 5.3 in Bohm 1987).

This is panpsychism, but it is *not* a claim that “consciousness should be present in atoms.” It is a *process view* of the world, similar to that of A. N. Whitehead (1861–1947). What we take to be ‘merely’ mechanistic interactions are better seen as the interplay of structured causes with structured effects – that is, semiosis. From a process point of view, all phenomena, from the sub-atomic through the everyday world to prodigious cosmological happenings, reflect continual and continuous dynamic interchange. As Whitehead put it: “we should reject the notion of idle wheels in the process of Nature” (1938a: 214).

However, as we encounter the world, our commonsense attitude is to think of it as made up of separable things, allowing us to go about our daily affairs effectively. Science has extended this attitude from things which we do encounter to things which we don’t and treats the world as thing-like at all scales, from the very big to the very small and everything in between. This surmise has a lineage that reaches back to Democritus. As the success of science and technology in the last four hundred years shows, it is a reliable means to discover fundamental ways to manipulate the world.

But a process view of the world offers a complementary attitude. This is to treat ‘things’ as abstractions from what are, in fact, processes. This attitude too, has a long Western lineage, conventionally beginning with Heraclitus. More recent examples are Whitehead’s organic metaphysics and C. S. Peirce’s view of semiosis as a dynamic network which allows nature to develop habits.

Adopting this attitude does not directly change how we manage our encounter with the world. We still act on the basis of the classical view, in the short term at least. In the longer term, though, it profoundly changes our understanding of that action. If our actions and what they act upon are not actually what we think they are, they are, eventually, more likely to be harmful, especially action en masse. The damage presently being inflicted on the biosphere shows this all too clearly.

Science and technology are out of control, not only because of political and economic forces but also because of fundamental limitations to the worldview on which they are based. If we treat the world as if it were merely an inert collection of things, the patients of our actions, we place ourselves in a privileged but dangerously isolated position. If, instead, we treat the world as a web of organic processes, then it becomes easier to realise that our actions are harmful if they are not in harmony with it.

The modern scientific worldview has served us well but its dangers are now becoming apparent. Trying to understand the world by reducing it to mere matter in motion will give us only limited understanding. Recent developments, particularly in the life sciences, are driving a fundamental re-appraisal of this reductive stance. Advances in genetics have shown that development and evolution must be treated together. The autopoietic theory of Maturana and Varela, allied with Margulis and Sagan's (2002) symbiogenetics, both show how living organisation arises and is sustained by a continuous network of semiotic exchange.

The underlying movement here is towards Whitehead's surmise that: "when you push your observations beyond the presuppositions on which they rest [...]. Any division, including some activities and excluding others, also severs the patterns of process which extend beyond all boundaries [...] connectedness is the essence of all things of all types" (1938b: 21) Gilles Deleuze (2006) makes extensive use of Whitehead in encouraging us to think of philosophy less as a way of describing how the world and more as a means to continually rupture and reform our intellectual resources. This benign intellectual anarchy will help to repair the damage being done by a worldview based on the imposition of boundaries where there are none. The limitation of the modern scientific worldview reflects just this inability to think about the processes which span conventional boundaries. This is the "arbitrary discontinuity" noted above.

Removing the threshold inserted between what we call organic and inorganic phenomena is panpsychism, and it is based on reason, not mysticism. Doing so will enrich biosemiotics and place it within a necessary ethical framework. It will allow us to see, as theologian Abraham Heschel has recently put it, that: "The good does not begin in the consciousness of man. It is being realised in the natural cooperation of all beings, in what they are for each other. Neither

stars nor stones, neither atoms nor waves, but their belonging together, their interaction, the relation of all things to one another constitutes the universe. No cell could exist alone, all bodies are interdependent, affect and serve one another” (Heschel 1976: 121).

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PROOF

PLAY

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Thus semiotic freedom is an emergent property and should always be analyzed in relation to its proper level.

[...]

We shall suggest the term interpretance as the measure of the capacity of a system to respond to signs through the formation of meaningful interpretants. High interpretance allows a system to “read” many sorts of cues in the surroundings; such high-level interpretance means that the system will form interpretants in response to complex cues that might not be noticed...by low-level agents.

[...]

All this indicates that there is an aspect of play in the evolutionary process...which has been more or less overshadowed...by the Cyclopsian focus on selection... “What is characteristic of ‘play’”, writes Gregory Bateson “is that this is a name for contexts in which the constituent acts have a different sort of relevance or organization from that which they would have had in non-play”. Bateson also suggests the definition of play as “the establishment and exploration of relationship” [...]. Thus, to the extent that the living world is engaged in an open-ended and nonsettled exploration of relationships between systems ...it can truly be said that nature does, in fact, exhibit play-like behavior. It therefore will be as legitimate to talk about natural play as a force in the evolution of life-forms, as it is to talk about natural selection. Selection acts to settle things... thereby putting an end to some element of ongoing play in the system while simultaneously providing for the beginning of whole new kinds of play.¹

¹ Hoffmeyer, Jesper 2008a. *Biosemiotics: An Examination into the Signs of Life and the Life of Signs*. Scranton and London: University of Scranton Press, pp. 196–197.

There are very many places in Jesper Hoffmeyer's work where I have been brought up short with thought-provoked pleasure: his discussion of the central importance of membranes (and skin and brain originating from the same germ material) in *Biosemiotics*, for instance, (2008a: 17) and his various discussions of intentionality and mind as systemic in biocybernetic, recursive organisation. But the things which stand out for me, as a teacher of literature and culture, are two. The first is the reference to Gregory Bateson's claim about the reality of biological 'stories' in the Introduction to *A Legacy For Living Systems: Gregory Bateson as Precursor to Biosemiotics* (Hoffmeyer 2008b: 2). The second is the idea of 'play-like behaviour' in the chapter from *Biosemiotics* quoted above. These two things (stories and play) seem clearly related. I discuss this below with reference to Roman Jakobson's model of (poetic) language (Jakobson 1960). The point I derive is that the development of literary meanings in narratives – which readers must *play* with to discover – imitates the processes of natural evolution. In a reworking of Jakobson's schema, I suggest that the paradigmatic patterns which are selected (thus forming the genre of a story) are, themselves, the subject of playful recombination in and from new contexts, thus providing new articulations of patterns for selection. Terrence Deacon writes "I believe that the experience of being alive and sentient is what it feels like to *be* evolution" (Deacon, 2002: 153). Living systems, we might say, are their own creative readers.

Thinking about the growth of meaning in literature, one can use Jakobson's model of the two axes of association: the vertical axis of paradigmatic (i.e. metaphoric) association and potential substitution via similarity, and the horizontal axis of association via metonymic contiguity. Jakobson expressed this in his formula (in regard to the poetic function – although it surely goes wider) that the relation between the two axes consists in the projection of the principle of equivalence from the axis of selection to the axis of combination (1960: 358). But, as Terence S. Turner argues (1977), a persistent narrative (metonymical) association repeated *over time* hints at metonymy's metaphoric potential and constitutes the patterned basis for *metaphoric* substitution.

Thus, we need not say that Jakobson's two axes are wrong, but that they are more closely interrelated such that "the universe of relations comprising the narrative as a whole [is transformed] into a

set of dynamic principles with the power to generate and control the order manifested by that universe: in a word, to reproduce itself" in narrative time (1977: 141–142). Jakobson is associated with Structuralism (i.e. the attempt to identify structures of meaning-production); but it is clear that what his axes actually model is not static structure but, rather, the evolution of structuration both *as form* and as formal semiotic constraint (or cause). In literary analyses, we recognise these things as the formation (via paradigmatic choices and their combination) of choices which both structure and determine specific discourses, or genres, in culture, and also develop (final cause) constraints on interpretation in narratives. Nonetheless, and while formal and final causes put limits on semiotic freedom of interpretation by 'low-level agents' (individual 'cells' of meaning or metaphor/metonym organisation), at the higher level of narrative/story ('multicellular') organisation they make complex 'high-level' interpretants of natural and cultural 'surroundings' both possible and evolutionarily useful (i.e. *meaningful*).

As Turner argues, repeated pattern of paradigmatic structure at a 'higher' narrative level "is really a syntactic or combinatorial device" such that "the principle of combination is reciprocally projected onto the axis of selection" (1977: 145). Far from being mutually exclusive, there is a creative and complementary tension between the two axes. In 'Dante . . . Bruno . Vico . . . Joyce', Samuel Beckett gives an example of the evolution of language via both kinds of association in the Latin word for 'law' (*lex*):

- 1 Lex = Crop of acorns.
 - 2 Ilex = Tree that produces acorns [the *Quercus ilex*: Holm oak or Holly oak].
 - 3 Legere = To gather [acorns or people for a village meet under an oak tree].
 - 4 Aquilex = He that gathers the waters.
 - 5 Lex = Gathering together of peoples, public assembly.
 - 6 Lex = Law.
 - 7 Legere = To gather together letters into a word, to read.
- The root of any word whatsoever can be traced back to some pre-lingual symbol. (1976: 114–5)

A visual representation of this process looks strikingly like the growth of a complex multicellular organism.

It is surely right to say that biological, as well as aesthetic, life is made of stories. Just as a reader plays with resonant patterns in order to discover (recursively and in narrative time) the growth of poetic meanings, so evolutionary life – on the basis of a primordial difference initiated by the coming into being of a membrane – plays with patterns of similarity and difference metonymically encoded, recursively *informed* and shifting (as Denis Noble (2006: 104) puts it) “from one metaphor to another”. As Laura Shintani has noted, Jakobson was fully aware of the correspondences between the genetic code and encoding in language. As she writes, in his review of Francois Jacob’s *The Logic of Life: A History of Heredity*, “Jakobson introduces the idea that the linguistic model can be in some respects mapped on to the problem of molecular heredity [...]. ‘Biologists and linguists as well have observed an impressive set of attributes common to life and language since their consecutive emergence. [...] The makeup of the two codes – the genetic one, discovered and deciphered by molecular biology in our time, and the verbal one, scrutinized by several generations of linguists – has displayed a series of noticeable analogies’” (Shintani 1999: 9–10).

“Selection”, as Hoffmeyer writes in the main quote, above, “acts to settle things”. But combination, allowing the possibility of new metaphors emergent from the evolution of hierarchically nested meanings, provides “for the beginning of whole new kinds of play”. Such abductions, as Bateson drawing on Peirce observed, are the basis of creative evolution in biology and in human culture. In introducing the idea of *natural play* and stories, alongside *natural selection*, Hoffmeyer (and biosemiotics) reminds us of the ‘necessary unity’ between mind and nature, and of the *living* nature of the patterns which connect them (Bateson 2002).

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PROBLEMATIQUE

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The term “information” has become nearly omnipresent in modern biology (or medicine).¹

Information is a condition for everything and I, too, believe that it is omnipresent. So, I think that Jesper Hoffmeyer has made an important point above, which I agree with 90%: “information” as a concept (and/or image/illusion in Jacques Lacan’s sense) is used, or misused, in so many contexts. My *problematique* (a French word, which I use here in the same way as the French Epistimeologists and structuralists – e.g., Gaston Bachelard, Lacan, Louis Althusser – do), then, will be to discuss how other perspectives can enrich the perspective of Jesper Hoffmeyer.

As a philosopher (and a Dr. and Professor in Sociology) I refer often to Hans-Georg Gadamer’s *Wahrheit und Methode*. I would like to call it a manual of understanding the riddle of Hamlet – “To be or not to Be, that is the question” – that, as such, stands as one of the most important works of the 20th century. “The greatest prejudice of the Enlightenment is the prejudice of abolishing prejudices” (1989: 329–340) writes Gadamer. And in this, his Magnum Opus, he tries to expose the ontological character of the individual’s understanding and the world.

Between you and I something happens: this is dialogue. We try to understand others, things, texts, objects of art. Our horizon is

¹ Hoffmeyer, Jesper 2010. Semiotic freedom: An emerging force. In: Davies, Paul; Gregersen, Niels Henrik (eds.), *Information and the Nature of Reality: From Physics to Metaphysics*. Cambridge: Cambridge University Press, 185–204 (p. 185).

determined by the place and point of time from where we are and when we exist. In this dialogue, something happens, we gain new knowledge – a “fusions of horizons” occurs. This is a kind of wise (not “essential”) information about the ontological status of *Verstehen* (understanding). Thus, Being is homological to Tradition. And understanding this has consequences for our understanding of conflicts (Feuds, Streit) and/or consensus.

However, there is one, as I see it, minor problem with Gadamer: For a conservative thinker like him, Tradition can make it difficult to legitimize Critique and Pure Reason. I think that we thus also have to make some room for Sigmund Freud’s notion of *Deutung* (a word hard to translate, it is closer to “decoding” than to “interpretation”) and Karl Mannheim’s notion of *Dokumentarsinn* (Documentary meaning) when discussing what has been deemed to be, and pretends to be, Information. For as Anthony Wilden – along with Jesper Hoffmeyer – has reminded us, information is both analog (a continuum movement) and digital (binary oppositions and differences).

There is, however one problem: old intellectuals (like me) run the risk of becoming “hyper-reflexive” (see Saas on this kind of “disorder” and the problems it creates, and is caused by). So we have to try to stay sane, by maybe using meditation and understanding spirituality. (This is not a command – only friendly advice, Jesper!) My conclusion would then be that information should be complemented by the experience of quietness and harmony.

Too, if we remember what Zygmunt Bauman wrote in 1978, we can probably improve our understanding of “understanding”. In the book *Hermeneutics and Social Science*, Bauman discusses Wilhelm Dilthey, Martin Heidegger and Hans-Georg Gadamer, and writes that: “Dilthey [...] never ceased to be fascinated by the ideal of objective understanding of history” (Bauman 1978: 170). And what I take this to mean in that our understanding is not historical in itself – and that this, too, then, is a kind of objectivism.

And as with all forms of objectivism, the ground remains shaky. Martin Heidegger postulates that there is no understanding outside history: “Understanding is tradition engaged in an endless conversation with itself and its own recapitulation. Understanding is the modality of existence” (*ibid.*). Is this Hoffmeyerian “information”?

In Gadamer's own words: "Where there is real language, the thing to be designated is not known prior to the act of designation. Rather, within our language relationship to world, that which is spoken of is itself first articulated through language's constitutive structuring of our being in the world" (1976: 115).

In the words of Ingrid Scheibler (2000), Gadamer is situated "between Heidegger and

Habermas". If we incorporate the ideas of George Herbert Mead – who made the relation and distinction between "I" and "me" well-known – we may arrive at the form of a model for "information" that looks like this:

I/me ————— Language ————— World

Language, or more precisely, "Information" is thus the mediator between the world and our selves. And, to quote Jesper Hoffmeyer, it is "ubiquitous".

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PROPRIOCEPTION

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*Even though natural science cannot deal with consciousness as such, it is possible by way of science to try to understand what is needed in order for a system to have consciousness.*¹

In 2001, Jesper Hoffmeyer wrote an occasional piece which, after translation, was published as ‘Proprioception’. His essay reflected upon the form of consciousness in living organisms and the link it has with proprioception, as had been outlined a few years earlier by Maxine Sheets-Johnstone (1998).

Even though most people imagine themselves to be ‘conscious’ (though in reality this is no more than a deterministic and conditioned, reactive state), it might nevertheless be useful to examine the connection between *proprioception* and the conscious state, since the importance of this connection should not be overlooked.

Etymologically, in ‘proprioception’ we have *proprius* (one’s own self) and *percipere* (to receive = to apprehend). This derivation gives to proprioception a scope broader than that usually entertained by human physiologists – namely, perception of the position of the parts of one’s body, especially in relation to their movement. In animals, proprioception is assisted by stretch receptors in muscle spindles and baroreceptors in the inner ear. Plants, also, are capable of perceiving their position in much the same way – by displacement within a gravity field, say, or on account of a light gradient. Unicellular organisms, too, show awareness of their own movement

¹ Hoffmeyer Jesper 2002. Proprioception. In: Emmeche, Claus; Kull, Kalevi and Stjernfelt, Frederik (eds.), *Reading Hoffmeyer, Rethinking Biology*. (Tartu Semiotics Library 3.) Tartu: Tartu University Press, 31–34 (p. 32).

and position within a volume of fluid; and, moreover, their membranes contain stretch receptors which make the unicellulars sensitive to their own form (Martinac; Kloda 2003).

Having in mind the etymology of proprioception, one may easily – perhaps too easily – slip into speaking of an organism's sense of 'self' and, hence, of 'self-consciousness'. However, the notion of movement in relation to proprioception, and thence to the awareness of self, concerns the body, or soma. Somatic proprioception leads to apprehension of the somatic self in time and space. But is there not another consciousness besides somatic consciousness that is independent of motion?

Skipping over 500 years of philosophy, we shall simply claim that 'self' and 'consciousness' are composite states arising from a simultaneous sensation and awareness of soma, psyche and feelings (affectivity). It should therefore be possible to reach the self-conscious 'I' about which Hoffmeyer prefers not to comment, holding that this topic is too subjective for scientific discussion, where the preference is to frame enquiries concerning natural phenomena using impersonal words like 'this' and 'it'.

What is this self-consciousness and self-awareness that troubles Man's thought and has thereby given rise to so much philosophising? The solution to this problem becomes clearer by considering the question in the light not only of proprioception but also of insides and outsides. We find support for our answer in Michael Conrad's (2000) idea that cyclical processes comprise the life of biotic entities, which can thereby reach a state of closure and so achieve optimal equilibrium with the environment. However, cycles can be disturbed and become leaky. Closure fails and gaps in the entity's boundary allow the environment to intrude and force a re-alignment or adaptation of the original cycling process and, hence, favour evolution. Homeostasis and mutation are the two regulative processes concerned and may thus be recognised as characteristics of life. According to Conrad, both are properties built into the physics of the universe.

Closure and anti-closure are exactly what are required in the search for, and apprehension of, consciousness and self-consciousness – a search that is embedded in the traditions of religious practices (*religio sensu* 'I link'), extending from Buddhism founded in the 7th century to Subud in the 20th. The common feature to

these and related practices is a certain type of relaxation which intrudes, via somatic proprioception, upon the boundary between the outer somatic and inner psychic/affective selves. Proprioception, the awareness of the tensions in the soma, is the shock which calls the inner self of affect and psyche to attention, an act which we might call 'psycho-affective proprioception'.

We may remark a little more upon this boundary between inner and outer. The outer somatic portion of an organism is comprised of a reactive surface upon which signs, icons, etc., hold sway. These items, and the regulatory behaviour they engender, are temporal and causative. Together with memory traces, they lead to associative thinking. The interior portion wherein the processes of mind, body and affectivity meet in conscious association, is atemporal and unconditioned, existing within the duration of now, where signs loosen their grip. Thoughts arising within this association are pristine, untrammelled by habitual, conditioned forms of mentation. The inner-outer boundary is nevertheless subject to dynamic, energy-regulated closure and anti-closure. The atemporal state cannot be sustained, and the temporal, sign-conditioned state once again dominates. Life, as we know it, cannot function otherwise.

Relaxation as a therapy for stress was summarised in the context of the aforementioned religious practices by Herbert Benson in 1969 (Benson, Beary and Carol 1974). Earlier, this methodology had been given a scientific gloss by Trigant Burrow (1938), who distinguished two attentional patterns, 'ditension' and 'cotension'. The former pattern focusses upon external objects and mental images, the latter upon the somatic, propriocepted tensions to which all individuals are subject, but which are only occasionally heeded consciously and non-reflexively. Inspiration-expiration cycles diminish in frequency and amplitude; and, together with affective-mental proprioception, there is a retreat from the fantastical, neurotic world of the mind to an equilibrated state comprised of simultaneous self-conscious awareness of mind, body and emotions.

The cotensional state allows freedom of the mind from the perpetual kaleidoscope of mental associations – the 'electric memes' described elsewhere (Agnati, Barlow, Ghidoni, Guidolin, Fuxe 2012), to which icons, in particular, contribute an inordinate share. Probably an altered allometry of human cerebral and cranial development, as well as the acquisition of language, permitted the

exaptation of the neocortex to make possible the harbouring of these local electrical neuronal networks of memory. Thus, the quietening of the mind by mental proprioception – the damping down of the meme-generated fantasy upon which much of culture is built – admits the sensation of a presence that the aspirant of self-awareness can justly call an ‘I’. Conscious proprioception is the portal at the metaphorical foot of “Jacob’s Ladder” or Walter Hilton’s “Ladder of Perfection” and is the goal sought by religious contemplatives via relaxation and meditation. Nevertheless, full self-consciousness is evanescent, as practitioners of meditation well know: self-consciousness requires it to be bound to proprioception by ‘attention’, as has been suggested in an academic framework by Michael Posner (1994), for example, and later elaborated by Raffone and Srinivasan (2009).

Finally, we recall that microbial cells, by accomplishing an outside-inside exchange, are enabled to search for a higher energy source (Taylor, Zhulin 1998); and that plants, too, seek actively for higher energy in the form of photons. Why should Man not also be roused to seek for something higher by attending to the conditions for proprioception which leads to self-consciousness? Voluntary, intentional proprioception could be a factor in Man’s psychological evolution (Ouspensky 1950).

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QUESTIONS

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*Understanding is and remains subjective.*¹

During my reading of Jesper Hoffmeyer's doctoral thesis *Biosemiotik. En afhandling om livets tegn og tegnenes liv* (2005), a number of fundamental questions took form in my mind: Can the living and non-human biological beings ever be said to 'understand' what they interpret? Is the 'mind' (and a brain of a certain size) not a 'necessary but not sufficient' condition for the existence of something that can be called understanding and thinking? If you pour water on a dry plant, or the sun shines on a flower thirsting for light, it has not freedom to avoid 'getting a hold on' the water, nor will it turn away from the light source. However, a man can commit suicide, choose to starve, be jealous, do others hurt, be anxious, 'forget' by intention, act irrationally, etc.

The question is, in other words, whether biosemiotics strains semiotic insights when they become applied to every living creature in the world. It could be that much of the world works quite automatically and sign-indifferently, and it might be the case that some cause-effect relationships do not have to be semiotized. It is not free of charge to claim that the world primarily consists of signs. Among other things, it is debatable whether biosemiotics is the ontological truth about the world. Everything consists of 'process organization' and not of particles, Hoffmeyer claims – but can biosemiotics even specify how it will be able to be falsified as a project and as a science?

¹ Hoffmeyer, Jesper 2011. Mønstringen af verden, *Weekendavisen*. (Bøger, 14 October.)

In an eloquently written newspaper article 'Mønstringen af verden' in the weekly Danish newspaper *Weekendavisen*, Hoffmeyer wrote the quote at the top of this page – just after a small text sequence on the relationship between gene specifying features and 'Planck's constant of understanding'. But I do not find this assertion convincing, because there are probably many sign-oriented processes of understanding, e.g. decoding processes and phenomena in the living biological and biosemiotic world, which happen not to be 'subjective' at all. And is it possible to use the concept 'subjective' both as a valid philosophical term and as a scope of logical conciseness for deciphering anything other than what is filtered through the consciousness of the human animal's comprehension processes?

Hoffmeyer insists rightly that such genetic information requires interpretation in order to work, implying that there is more at play in nature's complex processes than what can be dealt with using a probabilistic and formal information concept. In numerous publications, he has shown that the cell can interpret the same 'genetic information' quite differently depending on the context in which it finds itself. But does understanding necessarily become 'subjective' for that reason? It is Hoffmeyer's credo that when information is meant to work, then information will not be a unique thing that can be defined in objective terms.

He and I have spoken and written a bit together on these things recently (October 2011), and as he looks at it, either we have to accept that we talk about causality (in an 'objective' context) or about sign processes (in a relation to 'the subjective', which e.g. depends on the cellular 'agenst'). However, I would prefer to reserve the term 'subjective' to the human action field, including the utmost different experiences and cognitive processes which happen to take place in different individual and social contexts – and thus not use this term as polar and antithetical to the concept of 'objective'.

Rather, I believe, much clarity would be gained by thinking about a 'third' form of understanding that is neither 'objective' nor 'subjective'. Cells may be biosemiotic sign interpreters and not causally embedded neutral machines, but they are not 'subjective' (this being said, although, strictly speaking, we do not know nor can ever come to sense or feel what exactly is going on in other people or in living organisms when they interpret and 'understand'). A

challenge for biosemiotics could be to try to invent a vocabulary that does not fall into one or the other extremes of the historical-overbearing dualistic quagmire: i.e., either 'cold' objective information or 'hot' contextual subjectivity.

Is it fruitful to attribute actorhood, subjectivity and reflexivity abilities to everything from cells, DNA sequences, birds and cows, to educational processes and research communities? Why use an anthropomorphic epistemological conceptual arsenal on understanding processes that are neither 'objective' nor 'subjective'? This rigid either-or logic is likely to lead us astray, whether we are scientists or newspaper readers. We might better heed Wittgenstein's famous statement that we do not share the life of a lion and therefore, strictly speaking, cannot know what makes sense for it. We live outside its 'language game' – i.e. the major signs and interpretation processes it is living by and among. (A challenge that I want to thank the biologist and philosopher of science, Claus Emmeche, for having made me aware of, may be that Wittgenstein is only partially right, because we humans, like lions, 'happen to be' equipped with legs, two eyes, a stomach, may feel breathless, feel hunger, etc. But this partial similarity between species does not persuade me, nor make it legitimate to equip lions with 'subjective' understandings.)

Summarizing my points, I accept the fact that we do not need to assume that the cell does not 'feel' something at the semiotic level, but I doubt that this capacity to differentiate should be labeled 'subjective.' Rather, I fear that the wide and exaggerated use of the term 'subjective' risks to dilute the concept and displaces it from other 'loaded' family-resembling concepts, such as reflection, awareness, thinking, self-understanding, etc. And does its overuse not, too, risk anchoring our own thinking to a dualistic vision: when you say 'subjective', you are forced to say 'objective' in a short while. The concepts are as thick as thieves. But if you choose to think in liquid scales, and degrees of semiotic freedom, between cells, lions and humans, it might be said that it is philosophically valid to talk about the ontological 'subjective' all the way through the living universe. But one has to acknowledge that this philosophical 'taste' is heading in an explicit collision course with the everyday language we also use and are penetrated by in the mutual exchange of speech acts and views. Is it a genuine

philosophical and biosemiotic ambition not ‘just’ to ‘subjectivize’ all living beings but also the power of everyday language?

Moreover, I very much miss a philosophical discussion of what Jesper Hoffmeyer exactly means by life (*bios*, *vita*). It will also be exciting and courageous if Hoffmeyer one day starts to grapple with the big excruciating and attracting ‘why’ questions, both on the ‘small’ axis: *Why* did man come to be? – and on the great: *Why* does semiotic freedom ever come to exist in nature? The lazy religious dogmatic parks his ‘why’ in God’s transcendent and omnipotent sphere, and the enlightenment philosophical-teleological thinking (e.g., Kant and others) promotes the view that it is the inherent *raison d’être* of nature to ‘produce’ man, the precious crown of creation, as a self-rationalizing, self-perfecting creature.

Both Leibniz and Heidegger asked – as we know without being able to or willing to respond with any metaphysical (self-)security: *Why is there something rather than nothing?* And although this question surely is basically still a research-productive and unanswered question, I am quite convinced that Jesper Hoffmeyer will insist that the life of signs and signs of life flourish very well in silence, and on contingent terms, and that they often take the form of self-organizing systemic exchanges, and that they cannot be captured nor can they become conceptualized by dreaming of ever gaining one answer to one of two pivotal ‘why’-question(s).

Still, however, I cannot help asking him, likewise, why did life and life habits evolve in nature at all? And how does he explain the groundbreaking and mysterious transformation from matter to life? In any event, it would be great enjoying and digesting what he writes, if he one day (well, it’ll probably take more than one day!) dares to enter into a systematic and critical dialogue with the past 2500 years of more or less speculative philosophical and theological bids on these eternally recurring questions and doubts.

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RECOLLECTIONS

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*That [evolution] has ultimately created intelligence is a striking fact, which is not easily explained in the absence of a theory of natural intentionality ('aboutness'). Biosemiotics, by positing interpretation in the center of its focus, necessarily admits semiosis as an inescapable feature of life.*¹

It was around twenty years ago that I met Jesper Hoffmeyer at an international and interdisciplinary conference. After a day of interacting with scholars of very different backgrounds, I happened to sit by Jesper at dinner. Not only was he an affable conversationalist, but I found that his excellent command of English allowed me to enjoy even more our discussions. I also found that he looked at the world much as I did; this was partly explained when we found that we were both professors of biochemistry.

At that time I was very much engaged in applying complex systems dynamics (including nonequilibrium thermodynamics, non-linear dynamics, and information theory) to problems in origin of life and evolution. Jesper mentioned his interest in semiotics, which was something new to me. The next day, I heard Jesper speak about how semiotics could be applied to living systems: something he called biosemiotics, and I was immediately fascinated by the potential of his approach.

While I had an intuition that there was something important in applying information theory to biology, I was also very much aware

¹ Hoffmeyer, Jesper; Kull, Kalevi 2003. Baldwin and biosemiotics: What is intelligence for? In: Weber, Bruce; Depew, David (eds), *Evolution and Learning: The Baldwin Effect Reconsidered*. Cambridge: MIT Press, 253–272 (p. 253).

of its limitations, particularly because it did not effectively deal with biological function and biological meaning. I was delighted when he published *Signs of Meaning in the Universe*, as it provided me with an insightful introduction to biosemiotics, and I have followed his contributions since (Hoffmeyer 1996).

Not only did Jesper teach me about biosemiotics and how to perspicuously apply it, but he also introduced me to other biosemioticians and their work, such as Søren Brier and Kalevi Kull, as well as Terrence Deacon, Claus Emmeche, Guenther Witzany, and Marcello Barbieri. When my co-author David Depew and I were organizing a conference held at Bennington College in 1999 on the role of mind and learning in evolution, we invited Jesper Hoffmeyer, Kalevi Kull, Terrence Deacon, and Søren Brier to participate and contribute to the volume, which added an important and essential dimension to the conversation.

Beyond that, Jesper is one of the finest and most decent scholars I have had the pleasure in knowing.

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REDUCTIONISM

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*Life is in every respect communicative.*¹

It is an interesting paradox in science, and especially in the humanities, that reductionism generally is considered an invective. This goes for we historians as well. We take the implications of the problem of induction very seriously – and that is why others often call us mindless empiricists.

The late Henrik Nissen made fun of the tendency among political scientists to formulate ‘covering laws’ of society and history with the following mock theory: “Whenever a state has acquired uncontested military hegemony in Western and Central Europe it will attack Russia, and the following winter will be unusually cold” (Nissen 1981: 199). This applies beautifully to the cases of Charles XII (of Sweden), Napoleon and Hitler, but to any historian ‘Nissen’s law’ is meaningless in itself because it doesn’t offer any explanation or insight into the actual cases: What did Hitler have in mind when he invaded? You might as well use the explanation of the comedian Eddie Izzard: “Hitler obviously never played Risk as a child”. This is both true (since this strategic board game wasn’t invented then) and funny, but it doesn’t count as an explanation either.

My own version of Nissen’s point is the even more pretentious Møller’s Theory on Literature: “A comprehensive study of Shakespeare’s collected works demonstrates without a doubt that, in reality, they consist of nothing more than a combination of common words

¹ Hoffmeyer, Jesper 2011. Liv er i et og alt kommunikativt. *Weekendavisen*, Oct. 14.

that can be found in any good dictionary. Further studies will most certainly demonstrate that this applies to other writers as well". This theory is even more true than Nissen's – but also even more meaningless because it suffers from what we might call 'reductionist overstretch'.

Historians can never hope to achieve the simplicity and beauty of a Newtonian law. However, we too must simplify. Deduction is problematic but reduction is necessary. Jorge Luis Borges has described the dangers of not reducing in his fable of an empire where cartographers were held in such high esteem that they finally managed to create "a map of the Empire whose size was that of the Empire, and which coincided point for point with it". The beauty of the fable lies in the fact that it is itself reduced to austere brevity. A description of the world in a 1:1 scale simply does not count as science since it would be redundant by definition. Any interpretation means identifying a pattern, a system or an order that is simpler or at least smaller than the totality of what is interpreted.

A famous reductionism is the "Biologismus" of the late 19th century that tried, at least on a theoretical level, to reduce human life to its biological components (Møller 2000). It had ontological, epistemological and ethical implications, or to put it more bluntly, it produced a lot of nonsense, much of which was used to justify cruelty against people on a previously unknown scale (Møller 2006). The Danish geneticist, Wilhelm Johannsen, wrote as early as 1914 a vitriolic and very funny critique of the strange need of his contemporaries to reduce human or societal phenomenon to biology. (Johannsen 1914) He called for clear demarcation lines between the understanding of the human world on one hand and natural explanation on the other. Johannsen didn't know Dilthey's distinction between understanding and explaining or Windelband's distinction between idiographic and nomothetic but his point was approximately the same.

Jesper Hoffmeyer is intellectually seen as a remote descendant of Johannsen. He oversteps, so to say, the demarcation line from the other side and reinterprets biology – or to be more precise, introduces interpretation to the biologists: "Life is in every respect communicative". It is a kind of monism, meaning that the same kind of scientific thought applies to both the natural and the human world: interpretation rather than the idea of covering laws, patterns of

meaning rather than biological facts. Suddenly the humanities have colonized biology and not the other way around. It looks very much like reductionism, but perhaps it isn't.

Hoffmeyer himself denies that he is a reductionist; on the contrary. In one respect he is right. The world is becoming an empire where information, communication and interpretation are held in so high esteem that the amount of information etc. already outnumbers reality. It began already a couple of hundred years ago. At a very early stage, the available literature on Shakespeare quantitatively overshadowed the oeuvre of Shakespeare himself. The present level of communication on anything has probably reached and surpassed the 1:1 ratio. From a Hoffmeyerian perspective, of course, there is no such ratio. More communication simply means that the world is growing. Whatever the case is, the need for reduction in order to understand is larger than ever.

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SCAFFOLDING

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*Rather than reducing organismic behavior to inherited holistic lumps of reflexes, so-called instincts, biosemiotics suggests new subtle kinds of learning in situ associated with the establishment of semiotic scaffolding.*¹

*The primary mechanism behind semiotic emergence is semiotic scaffolding, the key to nature's tendency to take habits in the biological realm.*²

*The network of semiotic interactions by which individual cells, organisms, populations, or ecological units are controlling their activities can [...] be seen as scaffolding devices assuring that an organism's activities become tuned to that organism's needs. And just as the scaffold raised to erect a building will largely delimit [...] when and how such fine-tuned activity should take place. [...] Semiotic scaffolding operates by assuring performance through semiotic interaction with cue elements that are characteristically present in dynamic situations such as catching of prey, invading host organisms, or mating.*³

*The genome is not controlling ontogeny, it scaffolds it (just as books do not determine culture, but they certainly scaffold it).*⁴

Semiotic scaffolding is a tool that supports our learning. [...] More than anything else the human supremacy over animals is based on our

¹ Hoffmeyer 2011a: 62.

² Hoffmeyer 2007: 156.

³ Hoffmeyer 2007: 154.

⁴ Hoffmeyer 2012.

*creativity when it comes to the invention of semiotic scaffolding, from frescoes to airplane stimulators.”*⁵

Semiotic scaffolding has been one of central concepts and themes in Jesper Hoffmeyer’s work, particularly in his writings after 2005.

It is a concept used already in Lev Vygotsky’s works, and later developed by Jerome Bruner (Vygotsky 1986 [1934]; Wood *et al.* 1976; see also Foley 1994), Andy Clark, and others. For instance, Clark (2008) speaks about language as scaffolding. Jesper Hoffmeyer’s role here has been: (1) to observe that scaffolding in this sense is always a semiotic scaffolding, and (2) to demonstrate that semiotic scaffolding is at work on all levels of semiosis, from the origin of life forward. This entails something very important and fundamental for the whole of semiotic theory.

The way Jesper describes semiotic scaffolding is in terms of its instructional bearing – he generalizes this important concept, and illustrates it with many examples. However, to specify the definition of semiotic scaffolding, stating more clearly its relationship to semiosis and code, would give us a central concept for general semiotics.

It is possible, and fruitful, to develop Jesper’s formulations and to conclude that semiotic scaffolding is a general result and function of semiosis. Semiosis as an active meaning-seeking-making process results often with the building of some relatively static or even quite solid structures that somehow embed in themselves the findings of that active searching-event of semiosis. The resulting structure is a scaffolding. It canalizes further behaviour. It is the frame for habits.

Scaffolding, too, is the building for the development of codes. In fact, scaffolding itself looks almost like a code – codes, too, being always a product of semiosis. What differs between codes and scaffolding is their functionality. A code can be described just as a correspondence, whereas scaffolding always has a helping-supporting task or function. Habit, as a product of semiosis, is always, to a certain extent, instructional. Semiosis is a learning process that produces scaffolding, that forms habits, that results in codes.

⁵ Hoffmeyer 2011b: 81.

Scaffolding, being a product of semiosis – and semiosis being a process that takes place in an indeterminate situation of incompatibility that life permanently creates and carries on – is a relational semi-stable setting. Scaffolding can be reproducible, but this is not its universal feature. Therefore, the role of the genome is secondary here (Hoffmeyer, Kull 2003: 262–263).

Scaffolding is a reduction of degrees of freedom (as noted by Wood *et al.* 1976: 98, and as early as Bernstein 1967) – and this is how scaffolding works, the reason it is useful.

Thus we may think of semiosis as a process that results in building scaffolding for further semiosis. The semiosis itself is a collaborative learning: the process that occurs when at least two codes that are mutually incompatible meet and interact.

Semiotic scaffolding is likewise so universal a feature of semiotic structures that we cannot even imagine a sign relation without it. Scaffolding is the way to keep and canalize communicational processes.

Hoffmeyer generalises the notion, so that we can think of the whole of an organism's body as a scaffolding. Scaffolding is what results from learning. Semiosis produces scaffolding that support semiosis.

I thank Jesper for all conversations, so creative, we have held during already two decades, in Copenhagen, Tartu, and many other places.

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SCHOLARSHIP

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*Interdisciplinary scholarship only becomes fruitful when we collectively take the risk to confront problems in the ways those problems may be seen within disciplines other than our own.*¹

Albert Einstein is known for his imagination as much as his intelligence. In order to understand the intricate dynamics of molecular interaction, he found it useful to imagine himself down at the level of molecules so that he could ‘see’ what was happening. In the quotation above, Jesper Hoffmeyer challenges us to invoke this same power of creative imagination in order to see problems in our own discipline through the eyes of those working in other disciplines. The field of biosemiotics, deeply enriched by the work of Hoffmeyer, constitutes an important exception in the world of academe wherein scholars struggle with seeing old problems in a new light.

I believe philosophers need more practice in seeing natural phenomena through the eyes of a scientist; this is my project in biosemiotics. There are many outstanding ‘problems’ in the contemporary philosophical investigations into the nature of life and mind that simply melt away once one considers them against the backdrop of evolutionary history, as a biosemiotician does. Three brief examples will suffice to make my point. An example from Hoffmeyer himself concerns the absurdity of philosopher Daniel Dennett’s conclusion that whether or not animals have intentionality

¹ Hoffmeyer, Jesper 2008. *Biosemiotics: An Examination into the Signs of Life and the Life of Signs*. Scranton and London: University of Scranton Press, p. xvi.

is beside the point; we have to pretend that they do in order to understand their behavior (Hoffmeyer 2008: xvi). Hoffmeyer is spot on to call this position absurd.

The ‘problem of other minds’ is a philosophical problem concerning our ignorance of other human and/or animal minds since we can never peer inside and make sure that an inner mental life is present and that we’re not simply being fooled by a clever robot. John Searle dismisses this skeptical line of thinking by arguing that if something is constructed in the same way (i.e., flesh and blood) *and* behaves in similar or at least comprehensible ways, then we have to assume that there is a mental life there just as we would expect (in other words, if it quacks like a duck...). But there’s an even more obvious point to consider, which is this: Why would humans be the sole possessors of intentionality in the natural world if we are the latest result in an extremely long process of active, experiencing, and adapting living things? Considered in this light, it makes no sense at all to have to *pretend* that other creatures have intentionality, no matter your philosophical position.

A second example concerns philosopher David Chalmers’ ‘hard problem’, which is to explain why it is that we experience the world qualitatively, with colors, sounds, and textures – what philosophers call ‘qualia’. In essence, the problem asks, if we are just physical creatures, why do we have all this mental experience, why can’t the physical processing go on ‘in the dark’, as Chalmers puts it (Chalmers 1995: 203). I should note that a lot of philosophers don’t take this problem seriously, and I’m one of them, but the reasons for why we reject it differ. Again, if we invoke the context of human evolutionary history we see that if our ancestors didn’t experience the world qualitatively and thus avoid food that smelled rotten, water that looked murky, and dark places that made them fearful, we would not be here! It’s a philosopher’s trick to separate the nervous system from experience and ask why the latter exists at all. Evolutionary biology teaches us that the two are inextricable because the main function of the nervous system is to keep the organism in touch with its environment, which enables it to behave in survival-enhancing ways.

The last example concerns the problem of mental representation, a term that has a long, dark past ever since René Descartes proposed the theory that inside the head were pictures of all the objects in

one's surroundings, an idea now known as the Cartesian Theater. It is common today for philosophers of mind to reject not only the Cartesian Theater account of mental representation, but mental representation *en toto*. But the plainest fact available to us after even a moment's reflection is that we do in fact represent in our minds not only the body's internal states, but also environmental surroundings – and not only immediate environment (present in time and space) but also things, people, and places in memory or imagination. How exactly we do this is an open question in neuroscience, though many pieces of the puzzle are available, and researchers are actively working on it, which is a better approach than denying the phenomenon completely, which is a philosophically untenable position to hold.

Hoffmeyer's quotation certainly rings true for philosophers who have come to biosemiotics with the intention of finding more scientifically satisfying accounts of puzzling phenomena in life and mind, such as myself. But it also serves the broader purpose of reminding thinkers in a multidisciplinary effort such as biosemiotics that effective collaboration is going to take some creative imagination.

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SCIENCE

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Biosemiotics suggests that living systems should be studied as semiotic systems in their own right. This idea is based on the belief that the poverty of information discourse in biological sciences results from the reductive neglect of the interpretive aspect of biological information. By introducing the concept of the sign, as developed by US chemist and philosopher Charles Sanders Peirce [1839–1914] as a substitute for information, it will be assured that the interpretive side of information is not neglected. In everyday parlance, a sign is simply “something that refers to something else”, like smoke refers to fire. This reference, however, cannot be brought about without a process of interpretation.¹

In the above quotation about the need for the study of living systems within a semiotic framework, Jesper Hoffmeyer argues persuasively for the enrichment of ‘information’ discourse in the biological sciences, due to that field’s traditional neglect of the interpretive component of biological information.

Sciences in general, and the biological sciences in particular, require the implementation of the scientific method to achieve credible and substantive results, and this method evolved over a period of more than two millennia. For this reason, it is not possible to attribute it to any one person. To be sure, it was initiated by the Greeks with Aristotle (384–322 BCE) and the Greek philosophers and underwent subsequent modification by Muslim scholars such as Ibn al-Haytham (965?–1040?). Subsequently, Roger Bacon (1214–

¹ Hoffmeyer, Jesper 2010. Semiotic freedom: An emerging force. In: Davies, Paul; Gregersen, Niels Henrik (eds.), *Information and the Nature of Reality: From Physics to Metaphysics*. Cambridge: Cambridge University Press, 185–204 (p. 189).

1284) introduced inductive reasoning. Later, René Descartes (1596–1650) proposed deduction as the appropriate procedure for the scientific method. Ultimately, Isaac Newton (1642–1727) would refine the process still in use today with his assertion that the scientific method required both induction and deduction.

In its present configuration, the scientific method requires an ordered sequence of steps for rigorous research: (1) pose a research question; (2) examine and review extant research; (3) propose a hypothesis to explain the data; (4) test the hypothesis through experimentation; (5) analyze the results of the experiment; (6) draw conclusions based on the evidence; (7) determine if the hypothesis is true, false, or partially true; and (8) report results.

With their use of the scientific method, which includes observation, classification, and explanation (or interpretation), scientists have had their greatest success with the first two of these because these aspects are the most accessible in terms of observable phenomena. It is this third area – explanation and interpretation – however, that has proven to be much more elusive. In this third realm, it is only with the introduction of the conceptual framework developed by Charles Sanders Peirce (1839–1914), that we have been able to increase our knowledge of living systemic behavior through the notion of *semiosis* – the comprehension and production of signs. In fact, Peircean semiotics deals with the entire complex process of verbal and nonverbal messages, including their generation, encoding, transmission, decoding and interpretation.

The example of the sign provided by Hoffmeyer, one based on Peirce's triadic conceptualization of a sign relation or sign action, connects the primary sign to its object via the production of an interpretant. Hoffmeyer provides the classic example of smoke (sign vehicle, the manifestation of the sign without reference to it significance), fire (the object to which the sign refers), and fear (interpretant, the system of construal of the relationship of the sign vehicle to its object), or the evocation of a specific physio-psychological response to the sign vehicle. This classic example appears in the commonly used English idiom "where there's smoke, there's fire", which means that when there is evidence of an event, that event is probably taking place. Peircean triadic (and tripodic) semiotics is essential to understanding living processes because it provides the biosemiotician with a systematic procedure to explain

biological phenomena. Interpretation, of course, demands that the (bio)semiotician translate the sign relation so that the interpretation is both accurate and correct.

The value of the scientific method has proven to be quite useful in the development and advancement of scientific knowledge. In this regard, various biological hypotheses that have been superseded by later research include spontaneous generation overturned by the Darwinian (Charles Darwin, 1809–1882) theory of evolution, and abiogenesis, or the development of life from inorganic matter via natural processes. A second is Gregor Johan Mendel's (1822–1884) theory of genetics now superseded by molecular genetics. A third is the miasma theory of disease, i.e., disease arises from 'bad air', and subsequently rendered obsolete by the germ theory. These three erroneous biological hypotheses, superseded by subsequent research and aided by superior instrumentation and the use of sophisticated computer programs designed to facilitate and enhance hypothesis formation, logical deduction, and empirical testing in a systematic and rapid fashion have advanced scientific knowledge significantly.

All too often, however, reporters and journalists report the results of scientific experimentation without critical analysis. As a result, an uninformed or under-informed and ignorant public accepts certain scientific findings as correct and reliable. Questionable sources, e.g., a few reporters and some journalists without appropriate scientific training, as well as anonymous blogs and web posting by uncredentialed sources contribute to scientific misinformation. In fact, in an essay in the venerable journal *Scientific American*, Krauss (2009) bemoans the ongoing fight of science against media disinformation.

While ignorant popular purveyors of alleged scientific facts contribute to an ever-increasing public ignorance, it is unfortunate that a very few disreputable scientists also contribute to this situation. Again, in the *Scientific American*, Ioannidis (2011) condemned unreliable claims and embellished outcomes in peer-reviewed research in medical journals because of increasing competition and conflicts of interest. Moreover, in an article entitled "Scientists' Elusive Goal: Reproducing Study Reproducing Study Results" in the *Wall Street Journal*, Naik (2011) points out that irreproducibility of research results has multiple explanations including the use of different equipment and materials.

In order to combat these two major sources of scientific disinformation including external misunderstanding (by uninformed media representatives) and internal weaknesses (caused by scientific deceit and dishonesty and other factors), we must rely on a principled application of Peircean (and perhaps Hoffmeyerean!) semiotic standards in which the ultimate phase of scientific experimentation – explanation and interpretation – follows ethical principles fully embraced by the scientific community.

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SEMETHICS

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*Semetic interaction refers to the tendency of living systems to make signs based on any persistent regularity. Wherever there has developed a habit there will also exist an organism for whom this habit has become a sign.*¹

This principle (or rather, “rule of thumb”) of *semethic interaction* (Hoffmeyer 2008: 189), directs our attention to the dynamical connectedness of living units: a connectedness that is based on certain cognitive capacities they possess and the related adaptive plasticity. This connectedness has an irreducibly semiotic character almost independently of the chosen conception of sign or semiosis (an issue far from settled in biosemiotics), and in this sense the principle can be held as more essential for biosemiotics than perhaps more controversial ideas about semiosis at molecular levels.

What should be specifically noted is the dynamic character of the principle. It is not only that when we detect a regularity, we can expect to find some biosemiotic agent taking advantage of it, but also that whenever a *new* regularity is established, we may expect it soon becoming recognized and exploited by some other agent(s). Such recognition may eventually change the conditions of stability of the whole ecosystem and if so, it functions as a new evolutionary force. Many semethic interactions belong certainly among

¹ Hoffmeyer, Jesper 1997. The swarming body. In: Rauch, Irmengard; Carr, Gerald F. (eds.), *Semiotics Around the World: Proceedings of the Fifth Congress of the International Association for Semiotic Studies*. Berkeley 1994. Berlin: Mouton de Gruyter, 937–940 (p. 937).

evolutionary forces, forces of the kind where sign-action seems to have an irreducible role.

However, as valuable as such a rule of thumb may be as a generator of new hypotheses concerning e.g. ecosystemic stabilities or niche construction, there is the danger of getting carried away about the role of semiosis in the processes of life and evolution. Too semiotic-minded a visionary may over-universalize the role of semiotic interaction and end up in a kind of loose pansemiotism, where signs or semiosis are assumed to be responsible for every detail in life processes. Such a lapse is comparable to the adaptationist fallacy that many of the proponents of sociobiology and nativist evolutionary psychology have committed. Of the two kinds of adaptationism, Optimality adaptationism and 'Just so'-story adaptationism criticized by Stephen Jay Gould and Richard Lewontin (1979), the latter is relevant here. In it, every identifiable common trait is implicitly assumed to be a real adaptation, i.e. that nature has really selected it *because of* its advantageousness, which means that only adaptive historical explanations are drawn and felt legitimate without any demand of further evidence.

Biosemiotic thinking can hardly be accused of such 'Just so'-story adaptationism because of its opposition to oversimplifying or one-eyed natural selectionism. Instead, a biosemiotician may easily commit to *semiotic* 'just so'-stories, and the cause is of the same kind: a too vague, general, formal, or empty basic explanatory concept, be it sign/semiosis, or adaptation/selection, and to which no alternatives are seen (or they are rejected *a priori*). It is true that the vagueness of basic concepts can also be taken as a virtue that prevents us to force our view of nature too violently into oversimplified categorizations. The prize for excess vagueness is nevertheless the practical emptiness of the whole approach so that the use of semiotic terminology is mere renaming that does not help us to understand the phenomena any better than without it. Mere feeling that we understand better does not suffice. As such, semiotic terminology appears as mere reducible rhetoric.

I would like to pay attention to two points where a careless reader of Hoffmeyer (not Hoffmeyer himself) may fall on semiotic fallacies when studying semiotic interactions. The first one is that all 'persistent regularities' are not habits due to semiosis and all developed habits do not have a semiotic origin; they may as well be

‘non-intentional’ side-effects of semiotic processes (cf. CP 5.489) or due to material or other physical constraints just like the spandrels of San Marco in Venice. Whenever we detect a regularity, we cannot say much about the process that has produced it – although a detected regularity would be a habit with semiotic origin, it is recognized as a regularity independently on its origin. Further evidence about its origin is needed if such an issue even happens to have any significance.

The second point is more important. Although a regularity would be *perceivable* and even actually detected by some organism (or other biosemiotic agency), such a recognition is by no means *necessarily significant* to the organism. When perceptual and other cognitive capacities develop during the course of evolution, they often develop as *general* capacities, i.e. even if the perception of some environmental features were genuinely adaptive, the same capacity may provide, as a side-effect again, a possibility of perceiving a myriad of other features that are actually insignificant. Such possible ‘junk perceptions’ may nevertheless function as an important resource of developmental and behavioral plasticity as open possibilities whenever some of such insignificances turn significant.

Still, there is no necessity, again, that an organism would be able to develop any effective means to respond functionally to a detected and evidently significant regularity. Dysfunctional effects of the changes in weather conditions or of the appearance of a new parasite sometimes just have to be taken without any possibility for compensation. In such cases, new environmental features or regularities may function as evolutionary forces *independently of* their possible sign-character. Signs may also have non-semiotic effects that can be *even more significant* than their semiotic effects.

In biosemiotics, we should be careful to make a difference between these two kinds of significance that signs – or persistent regularities – may have, semiotic and non-semiotic. Such differences within semethic interactions cannot be drawn or even seen if concepts of sign and semiosis remain too general or vague, if it is not made clear what is the difference of a perception of a thing and interpretation of it as a sign of something, or if it is not made clear who or what is the agent of semiosis to whom this sign-action should be significant or meaningful.

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SEMIODIVIDUALITY

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*The 'meta-membrane' that is the human skin is indeed a highly specialized manifestation of the very same interior interface-principle whereby life processes are most generally built up.*¹

Jesper Hoffmeyer's biosemiotic conception of the 'semiotic body' can be extended by reading together along with Hoffmeyer, the scholars Charles S. Peirce, Thomas A. Sebeok and Victoria Welby – all of whose reflections have contributed to redefining the 'semiotic self' as a complex sign, verbal and nonverbal. As Peirce states, "It is that the word or sign which man uses *is* the man himself [...] the man and the external sign are identical, in the same sense in which the words *homo* and *man* are identical" (CP 5.314).

Noticing the similarities in the works of Peirce with the ideas of Hans Jonas, Hoffmeyer further observes that: "causality and teleology do not contradict each other; on the contrary, teleology is a precondition for causality to have sense. And *telos*, of course, is something we know of before we know of anything else for we know *telos* from our own bodies – or I shouldn't say 'our bodies': we *are* our bodies, or our bodies *are* us" (Hoffmeyer 2008: 171). The self, then, is an open-ended semiotic process, characterized by a capacity for interpretive-propositional commitment unfolding in an infinite number of signifying trajectories.

As a developing sign, the subject is a dialogical entity, an *open* subject emerging in the intrapersonal and interpersonal interrelationship with other subjects. The boundaries of the subject are not defined once and for all, but only emerge through dialogical

¹ Hoffmeyer, Jesper 2008. The semiotic body. *Biosemiotics* 1 (2): p. 175.

encounters with other subjects. The self is a community of dialogically interrelated selves whose development is oriented by otherness logic. Reading Merleau-Ponty (as interpreted by the Danish phenomenologist Dan Zahavi), Hoffmeyer notes: "When I experience my self, and when I experience an other, corporeality is the common denominator; 'we are similar because my experience of both myself and of an other is 'incarnated'. And because my experience of the self is necessarily an experience of a kind of corporeality, it cannot be separated from an experience of the 'other' – 'I am always a stranger to myself, and therefore open to others'" (Zahavi 1999, cited from Hoffmeyer 2008: 174). The subject's identity, in other words, is multiplex, plurifaceted, plurivocal, delineated and modeled in the dialogical relation among its parts.

Indeed, if we interpret the word 'in-dividual' literally as meaning 'non divided, non divisible', with Peirce, who rejected the "illusory phenomenon" of a finite self or self-sufficient self, clearly 'a person is not absolutely an individual'. The social character of self does not contradict its singularity, uniqueness or otherness with respect to any signifying process that interprets it. Welby, likewise, analyses subjectivity in terms of the relationship between the 'I' or 'Ident', and 'self' or 'ephemeron' (see Petrilli 2009). Self is mortal, ephemeral, like the body – whereas the 'I' tends towards immortality beyond the mortality of body and self. Here the subject is not unitary or compact, but presents a surplus, something more with respect to closed identity, as it emerges from the dialogical relationship between self and I. Ident is not the 'individual', but the 'unique': "It is in fact just our *dividuality* which constitutes the richness of our gifts" (Welby, "I and Self", undated typescript, in Petrilli 2009: 647).

That the subject is an incarnate subject, intercorporeal being, a body interconnected to other bodies, expression of the condition of intercorporeity, synchronically and diachronically, not isolated from other bodies, is essential to our conception of subjectivity. The subject is incarnate both in terms of biological evolution and of sociality and cultural history. The body is essential to the development of consciousness, a condition for its full development, therefore of the human being as a 'semiotic animal' (Deely, Ponzio, Petrilli 2005). Self develops interconnectedly with other bodies, human and nonhuman, through which it extends its boundaries, the boundaries of the world it experiences. The word is an extension of

the body. Echoing Voloshinov from his essay on recent tendencies in Western linguistic thought, originally published in Russian in 1928, the word forms a bridge joining one's own body to the body of others.

Hoffmeyer evidences the condition of interconnectivity in terms of the association between self and biological reference: "The skin has both an inner side and an outer side and an asymmetry is therefore established by the skin between that which is inside and that which is outside. The "self" exists only in so far as that which is inside contains an intentionality toward, or reference to, that which is outside – an *aboutness*, as it is often called. But this outward reference rests upon a corresponding inward reference, such that one could say: other-reference presupposes self-reference" (Hoffmeyer 2008: 174).

According to Sebeok's (2001) *global semiotics* the human being is born into the network of life, also a sign network, preexistent to the single individual. But human semiosis is characterized by a double modality of existence, at least: as biological organisms interconnectedly with other organisms in the *biosphere*; and as a specification of this vital sign network thanks to the human species-specific capacity for *metasemiosis*, or *semiotics*, or *language understood as a primary modelling device*.

Thanks to syntactics characterizing primary modelling, humans can construct, deconstruct and reconstruct an infinite number of worldviews with a finite number of elements, unlike other animals where the relation between modelling and worldview is univocal, unidirectional. Nonhuman animals are born into a world they are not programmed to modify, if not according to an original *bauplan* as established by the genetic patrimony of their species. Instead, thanks to syntactics, human beings are *metasemiotic* or *semiotic animals* with a capacity for creativity and criticism, suspension of action and deliberation. This implies that each human being is invested biosemiotically and phylogenetically with a unique capacity for responsibility towards life, care for life in its joyous and dialogical multiplicity. The capacity for making decisions, taking a stand, intervening upon the course of semiosis over the entire planet implies nothing less. In this sense, the 'semiotic animal' is also a 'semio-ethical animal'.

The semiotic capacity implies a third modality of being-in-the-world, specific to human beings, the *semioethical* (Ponzio, Petrilli 2003; Petrilli, Ponzio 2010). This is connected to our capacity for creative awareness of the other, responsibility for the other, answerability, which presupposes the global condition of intercorporeal dialogical otherness to which we are all subject biosemiosically as living organisms.

Semiotics demonstrates that whatever is human involves signs. Biosemiotics, which with Hoffmeyer reaches full status as a discipline, implies more than this: all life-forms and not just human life, whatever is simply alive involves signs. This is as far as cognitive semiotics and global semiotics reach. Semioethics pushes this awareness even further in the direction of ethics and beyond. From a semioethical perspective the question of responsibility towards the health of semiosis, therefore of life in its multifaceted aspects cannot be evaded at the most radical level, that of defining commitments and values. “And *telos*, of course, is something we know of before we know of anything else for we know *telos* from our own bodies”, as Jesper Hoffmeyer has said so well.

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SEMIOGENESIS

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*Whenever there has developed a habit there will also exist an organism for whom this habit has become a sign.*¹

At my doctoral defense in Tartu, December 15, 2011 (defending the thesis: *Umwelt transition and Uexküllian phenomenology: An eco-semiotic analysis of Norwegian wolf management*), Jesper Hoffmeyer was one of my two opponents, along with Dominique Lestel. The day before, I had belatedly been made aware of his coinage of the term ‘semiotic causation’ well before I mistakenly believed that I was coining it. At the defense, I acknowledged Jesper’s coinage, and we agreed that our respective descriptions of it are overlapping, and that the term deserves emphasis and further development.

Jesper’s work on the *topic* of semiotic causation far precedes his coinage of the term, and it also relates to other novel neologisms of his, including that of ‘semethic interaction’ (first called semetic interaction). Semethic interactions occur wherever a regular behavior or habit of an individual or species is interpreted as a sign by some other individuals and responded to through the release of yet other regular behaviors or habits. These, then, are instances of *regular (systematic, habitual)* semiotic causation (and when they emerge, there are cases of umwelt transitions). There are countless other categories of semiotic causation as well, but that of semethic interaction is no doubt crucial for biosemiosis as such.

¹ Hoffmeyer, Jesper 1997. The global semiosphere. In: Rauch, Irmengard and Carr, Gerald F. (eds.), *Semiotics Around the World. Proceedings of the Fifth Congress of the International Association for Semiotic Studies*. Berkeley 1994. Berlin/New York: Mouton de Gruyter pp. 933-936.

A decisive feature of semiotic causation is that what matters (what *comes* to matter) is what is *taken to be* a sign. A creature that releases (potential) signs might or might not succeed in communicating its intentions (if any) to another creature, be it a conspecific or not. However, these signs – qua sensual potentialities – might nevertheless have an impact. The power of semiotic causation originates from the eyes of the beholder. And what a power, what a force it is, semiotic causation! One of the most powerful forces of nature – manifested in and through our eyes (so to speak)! As manifold a realm as biosemiosis constitutes, it is nevertheless no unjustified generalization to claim that it is a realm ruled in large measure by semiotic causation.

But, unlike solely efficient causation, such causality is not at all easy to predict. En masse, the numerous instances and processes of semiotic causation represent all we know as creativity and ingenuity, and much of what we recognize as novelty. Jakob von Uexküll suggested that we ought to conceive of nature as a symphony – a composed whole with contrapuntal relations throughout. Frederik Stjernfelt was right to remark that nature (and evolution) is in fact characterized by improvisation, and is thus more of a jam. We are all results of evolution, which can be conceived of as determined no more by chemio-physical constraints and strict laws than by ceaseless spontaneity and habit-taking. A species-defining trait is but petrified behavior, a habit so fundamental that it is not experienced as such (in the long run, all behavior is habitual).

A biosemiotic metaphysics should definitively emphasize emergent phenomena, but not in any naïve manner which would suggest that all evolutionary or indeed cultural products are heaven sent. A habit is an ambiguous element, and no less imperative in the human realm than in the realm of the living at large. Habits define normality – our immediate horizon, what makes sense to us straightaway – and thus condition us to interpret whatever we lay our eyes on in certain manners. The question *Do habits facilitate easy understanding, or impede it?* does not have a universal answer, for while in one case a habit might enable us to recognize significant behavior without difficulty, in another it might just as well fool us to see only what we expect. Oh, how many do not confuse their *anticipated* umwelt with their actual umwelt!

But Man is an animal characterized by anticipation, an animal that in the era of the Anthropocene builds its entire existence on anticipation of a future which as it materializes never seems to fulfill the needs of this world-historical creature. We, too, are habitual animals, and we have in modern times refined a mentality which makes us incapable of simply accepting what is here ('a better world', that is our ultimate destination). Some prejudices die hard. Are we, in our global human ecology, refining our habits, or merely recycling them? This matter is urgent and crucial.

As the classical economist John Maynard Keynes wrote some eighty years ago, in pondering upon the economic possibilities of 'our grandchildren', it will not at all be easy to change deep-rooted habits acquired in poorer times. Keynes foresaw that humankind should by now have overcome its 'economic problem', the struggle for sustenance – and ought to start to develop a taste for prioritizing undertakings other than that of ever-increasing wealth.

This Q&A is informative: *How many stable elements are there on Earth?* Answer: 81. *And of these non-volatile elements in the Earth's crust which, taken as a whole, represent all that we know firsthand as natural matter, how many are we humans currently mining, and exploiting economically?* Answer: 81. This utilization of natural matter is certainly habitual, and as we plainly see, the habitual borders on the addictive and the compulsive (as well as on the spontaneous and the creative).

What kind of creature are we? Only people of the future can tell, for Man is a creature that defines itself – and thus defining 'humanity' is an ongoing process, which is in part conducted by way of our actual behavior, and cannot be concluded once and for all – which is why I am not a post-humanist, but rather a pre-humanist.

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SEMIOTIC FREEDOM

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In the semiotic understanding [...] the chemotactic machinery serves to integrate the sensing of the outer world to the reality of the inner world as this reality is described in the self-referential or genetic system [...]. Thus, from the modest beginnings, we saw in chemotactic bacteria, the semiotic freedom of organic systems would have tended to increase, and while it has not been easy to prove that any systematic increase in complexity, as this concept has traditionally been defined, has in fact accompanied the evolutionary process, it is quite obvious that semiotic complexity or freedom has indeed attained higher levels in later stages, advanced species of birds and mammals in general being semiotically much more sophisticated than less advanced species [...]. John Deely has called the human being the semiotic animal [...]. Semiosis, sign action, takes place all over the life sphere, but only humans know the difference between signs and things, only humans are semiotic animals.¹

One of the most important results in which *meaning* and *relevance* surpass the boundaries of semiotics, and which demands the reconstruction of the whole scientific paradigm, is an understanding that one and the same models function in both the systems that we are used to regarding as biological, and those which we consider social or cultural. Such attempts at integrating biological and cultural understanding are not anything new – one calls to mind, for instance, Herbert Spencer, as well as mention Social Darwinism – but almost all such previous attempts have been reductionist in their nature. Semiotics, on the contrary, approaches the situation from the

¹ Hoffmeyer, Jesper 2010. Semiotic freedom: An emerging force. In: Davies, Paul; Gregersen, Niels Henrik (eds.), *Information and the Nature of Reality: From Physics to Metaphysics*. Cambridge: Cambridge University Press, 185–204 (pp. 195–197).

holistic angle. It brings to biology, even at the level of cells, such notions as 'sign', 'meaning', 'communication' and even 'freedom' and 'creativity' (*poesis*).

It is interesting to note that this paradigmatic shift is a result of twofold efforts. On the one hand, it was concluded already in the 1970s by the Tartu school of the semiotics of culture that *text*, *organism*, *intellect* and *culture* are, in the semiotic sense, isomorphic formations – and this judgment was delivered from the standpoint of culture. Proceeding from the standpoint of nature, and from opposite directions, analogical conclusions are made by Biosemiotics which is, first of all, related to Jesper Hoffmeyer and his colleagues – who treat living organisms first and foremost as semiotic systems, with Hoffmeyer being very accurate in his implications and avoiding far-reaching generalizations. However, the way he describes biological sign systems often seems to be a literal translation of social sign systems.

Thus, on the one hand, semiotic models of culture are to a great extent similar to biological ones, and, on the other hand, biological models are codified in the same terms as cultural ones. But one can go even further. When Hoffmeyer, following John Deely's definition, considers the human being as semiotic animal who, like all other animals, uses signs, but is the only one to do it consciously – that is, knows the difference between 'signs' and 'things' – he still proceeds from the biological, and not the semiotic, perspective.

From the biological perspective, organisms, populations and species are given in advance and they use different forms of semiosis – while from the perspective of semiotics, the signs and different strategies of using them are primary. Organisms, populations and species are in this sense secondary formations, and from this perspective, the boundary between human being and other animals is not as rigid as it seems in Deely's and Hoffmeyer's approach. Moreover, an important distinction which has to be made is between the *intentional* and *non-intentional* use of signs, which is somewhere in between knowing and not knowing. The intentional use of signs is quite common in the animal world, and it is by no means a specific feature of the human being. For instance, many mammals, especially carnivores, can lie. That is, they use signs intentionally and can successfully draw a line between signs and things.

From the semiotic point of view, then, we could distinguish between: (1) systems wherein codifying, forwarding and receiving information, there is no freedom of choice (and wherein the only 'freedom' is to make a mistake); (2) systems which for themselves are without freedom, but mislead certain receivers who belong to other species (the first type of mimicry); (3) systems which at least to some extent can control their false signals (the second type of mimicry); (4) systems which are able to intentionally use signs characteristic of other species (e.g., the tiger who makes the sound of a deer to lure the latter); and finally, (5) systems which are able to reflect over their usage of signs and frequently change sign systems. The growth of semiotic freedom is one of the most important vectors of evolution.

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SENSEMAKING

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*Among biochemists, there is a rule of thumb saying that whenever nature keeps a store of energy (e.g., food) there will also always be a species that makes its living by consuming it. I shall suggest a quite similar rule of thumb by saying that there never occurs a regularity or a habit in nature that has not become a sign for some other organism or species.*¹

What does it mean, as Hoffmeyer points out, that there never occurs a regularity or a habit in nature that has not become a sign for some other organism or species?

Relating individual signs to the processes of individual organisms or species in a one-to-one correspondence – as in the case of the sensitivity of the active site in the bacterium *E. coli* to carbohydrates – describes how life makes sense of the world. However, the claim that the habits of nature are signs also seems to make sense at a more detailed individual level. Clearly, we can conceive of organisms as assemblies of one-to-one correspondences of regularities and responses that have individually evolved, but these thoughts are often constrained by the consideration of the overall functioning of the individual. Thus, the case of our cognitive processes easily comes to mind.

Human cognition consists of processes that are better explained with respect to their own ends than they are from the perspective of the entire organism. The obvious reason for this is that intertwined development is carved into the delicate constitution of every

¹ Hoffmeyer, Jesper 2012. The natural history of intentionality: A bio-semiotic approach. In: Schilhab, Theresa; Stjernfelt, Frederik; Deacon, Terrence (eds.), *The Symbolic Species Evolved*. Dordrecht: Springer, 97–116 (pp. 108–109).

organism and is based on mechanisms that consist of elements that can be traced back to tricks that have worked since the beginning of life. Simply put, the material of evolution consists of ensembles of processes that have been established in response to the habits of nature. Although they can merge into new constellations, each mechanism is so formidable that it may prove impossible to disentangle. To summarize, there is no built-in rationality to evolutionary progress apart from making sense of the habits of nature. This does not mean that evolutionary products do not make sense. They do. However, there is no master plan and no watchmaker crafting natural design.

The existence of multiple processes, each working in individual directions but still contributing to a collective purpose, is demonstrated in the constraints imposed on the running speeds of cheetahs. The cheetah is the fastest land animal in the world. She can move from 0 to 103 km/h in three seconds and run at speeds of approximately 120 km/h, over short distances of 300 to 400 m. This ability makes her potentially the most threatening predator that never comes second in a sprint.

However, what seems to limit her maximum speed over longer distances is not, as one may hypothesize, oxygen depletion but rather an accumulation of heat emitted from the working musculature that incapacitates her while she cools down. This effect is pronounced to such an extent that cheetahs can fall prey to local monkey species that take advantage of the exhausted carnivore. So, the ability of the cheetah to run at unmatched speeds is limited not by energy consumption by her muscles but by her inability to transpire and control her resulting body temperature.

Although the cheetah might actually be better off if she could continue her hunt over longer distances and thus keep parasitic monkeys at bay, her resulting maximum running speed would be influenced by many factors (i.e., the habits of nature) that eventually turn out to be counterproductive. These factors include the speed of the chemical reaction in neural transmission, the running speed of optional prey species, and the abundance of dangerous predators. Furthermore, hunting at breathtaking speeds makes sense in open terrains where opportunities to escape are abundant, whereas hunting in the jungle favours agile predators that can cope easily with obstacles and swift directional changes.

Likewise, human cognition consists of many separate processes that are productive in their own rights, although which still might be conceived of as constraining us at the level of the sensed self (e.g., Schilhab 2007a; 2007b; 2012). As beings that excel at consciously perceiving ideas, we are clearly misled by the prevailing sensation of us as a unity – the self. At the level of the individual, we might appear to be coherent and homogeneous, but at the lower levels making up the self many ends have to meet and make compromises since cognition did not emerge as a fully fledged tool that was already perfectly rational.

We are all complicated webs of responses to Hoffmeyer's habits in nature. This is proper sensemaking.

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SIGNIFICANCE

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*...the information that is contained in the very architectonic structure of the complete and fully functioning cell is of great significance...*¹

We here give testimony to Jesper Hoffmeyer's significance: his noteworthiness and his meaning; why he outstands and what he signs (Hoffmeyer 1996: Ch. 1; 2008: xvi). Sign-nature is his signature: the significance of significance (Hoffmeyer uses 'significance' in both senses) emerging from significance; how something became someone (Hoffmeyer 1996: viii), how the out-standing becomes sign.

Reflecting on Hoffmeyer. Whence 'significance'? In a nutshell, out-standing is always already potentially a sign. Thus significance begets significance. Significance is the mutual co-production of Peirce's Firstness, Secondness and Thirdness; or Bateson's differences that make a difference – but all the way down (Hoffmeyer 2008: 44).² Thus, *for-ness* constitutes being. Literally, 'isness' – *ousia*, *essentia*, essence – is through *for-ness*. For-ness is a precursor to the sign.

Differences that make a difference determine loci by constituting boundaries. Boundaries, differentials, distinctional processes (whether of temperature, pressure, density, velocity, etc.) are thresholds: differences that make a difference *for* something. It is lumpi-

¹ Hoffmeyer, Jesper 2008. *Biosemiotics: an examination into the Signs of Life and the Life of Signs*. Scranton: University of Scranton Press, p. 37, n23.

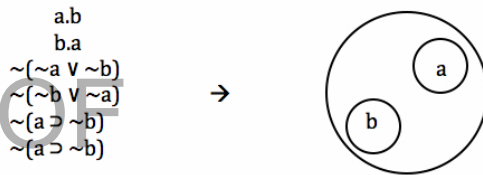
² Hoffmeyer cites P. V. Christiansen making this very equivalence: "the same entropic conditions [apply] to any *significant* event, to every *difference that makes a difference*" (Hoffmeyer 2008: 44, emphasis added).

ness all the way down and all the way back (Hoffmeyer here links the lumpiness of the universe to signification [1996: 3]). The material universe swarms with nestings of such distinctional processes. Surfaces within surfaces emerge, membranes, and eventually a massively complex ensemble of these can point to the sign-nature of skin ('Surfaces within surfaces' is the title of this magnificent chapter [2008: Ch. 2]). Something became someone as *for-ness* emerged skinwards.

1. *A critical disagreement.* Signifying emerges from significance by anticipation. Lumpiness is significant; but signifying requires *recurrent* significance because it pertains to *classes* of events. Classes are established by arbitrary criteria. These allow for recurrent regard of differences that make a difference and disregard of differences that do not. Variations of such criteria, randomly proposed, are by natural selection disposed. Hoffmeyer suggests that the inside-outside asymmetry of catalytically closed structures is so favored (Hoffmeyer 2008:36). But such structures must be asymmetric in principle. This, therefore, is an insufficient criterion for selection: *which* asymmetries are selected? Similarly for kinds of self-replication; these amount to variations in recurrent proposing: *which* are selected?

There is an oversight in assuming a need "to cope with an *ever changing* external chemical situation" (Hoffmeyer 2008: 37, emphasis added). In a rotating universe, the single ubiquitous feature of environments that makes them such is *cycling*. By definition an environment recurs. Which designs thrive? Those that withstood the past and are thereby likely to withstand the future. Robust designs always already embody predictions of an environment's future states. Tested recurrently, embodiments that withstand recurrence recur. Thereby selection in general favors anticipation. Optimized by selection, anticipatoriness, the recurrent forness required for signifying, brings forth "[l]ife's agency, it's inherent future directedness, its survival project" (Hoffmeyer 2008: 35). Anticipative systems – living beings – are nodes of causation, agency and subjectness (see Mayer 2012a). Through anticipation, something became someone, significance became signification.

2. *An analytical explication.* Nested skins classify, calculate. Consider the transposition of the calculus of indications into logic (Spencer-Brown 1994[1969]: 114):



By this transposition the six expressions of logical conjunction (two value logical operations that follow from distinction) may be simplified:

In words	In the sentential calculus	In the primary algebra
not a	$\sim a$	\overline{a}
a or b	$a \vee b$	ab
a and b	$A . b$	$\overline{\overline{a} \overline{b}}$
a implies b	$a \supset b$	$\overline{a}b$

“This is a proper simplification, since the object of making such sentences correspond with these symbols is not representation, but *calculation*” (Spencer-Brown 1994[1969]: 115, emphasis added; this expression is equivalent to the one in the table for “ a and b ”). Thus, an architectural structure *calculates*: in a house one may be in the kitchen or in the bathroom or in neither but not in both. In the diagram above, a and b state that this is so regardless of further nested structures (the larder, a shower.) This parsing of the world, calculation or classification, either by formal logic or by living cells, is accomplished by surfaces within surfaces. This is the full significance of “the very architectonic structure of the complete and fully functioning cell” (Hoffmeyer 2008: 37, n23). Sign processes (semiosis) = distinctional calculi.

3. *Conceptual extension*. Hoffmeyer points to the need for a metaphysically in-formed biology and a biologically in-formed metaphysics (Hoffmeyer 2008: Ch. 3). We remain as yet a babbling

community when speaking of causality, agency, substance, form. The nascent language of emergence, scaffolded by Aristotle's hylemorphism, might be named *hymenomorphism*: the membrane-foundations of knowing and the known; inquiry into form as emergent through nestings of distinctional processes, surfaces, membranes, skins (Mayer 2012b). Skinwards is anticipatorywards.

There is a deep isomorphism between all instances of layer-produced organization, from societies to cells. All such living processes embody *he is his own best friend who loves himself best; the friend is another self* (Aristotle) and *the self is another friend*. Joined in hymenomorphic inquiry into the subjects of nature, we embark with Hoffmeyer on a signature friend-ship that is the sign of our times.

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SPANDRELS

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*“Not” is a boundary. This boundary, the circumference, is unique because it exists nowhere but in the mind of the one who has pictured it, the observer. The boundary [...] forms the very roots of signification. Or, to put it another way: the boundary is not a part of the world unless “someone” chooses to picture it. And in a sense what or who this “someone” might be is exactly the question [...] Who is capable of making “lumps in nothingness”? When did it start? And to what did it lead?*¹

*The knack of forgetting holds the key to life’s knack of incorporating the present into the future. It is precisely because living systems carry out a selection process, forgetting somewhat more of what is “unimportant” than of what is “important,” that we can talk about memory.*²

*Yet once this relation had become safeguarded through the strengthening influence of natural selection, it did thenceforth, however, offer a reliable cue for the successive construction of yet further semiotic scaffolding.*³

*The growth in semiotic freedom through evolution is caused by the possession in living systems of an extreme semiogenic capacity, a capacity based on their ability to read omens [...] to take advantage of any regularities they might come upon as signifying vehicles, or signs. [...] Anything is an omen until we understand its true significance.*⁴

¹ Hoffmeyer 1996: 10.

² Hoffmeyer 1996: 14.

³ Hoffmeyer 2007: 157.

⁴ Hoffmeyer 2008: 188–189.

The string of quotations cited above is not intended to cherry pick but to sketch together a central topic of biosemiotic study, which is the ancient trope: How is it we are here? When Jesper Hoffmeyer tackles this question, the question loses its irrelevance and becomes an invitation to consider the structure and function of relational phenomena (which, as he shows, is *nothing* sans the inference of *not*) by inferring the existence of *semiotic spandrels*. Such spandrels serve as those structural constraints of semiotic scaffolding competent to generate origination, abduction, and meaning – and thus we see the self as a spandrel of semiotic scaffolding.

Essentially, as all good biosemioticians know, a sign stands for something else – constructively, dynamically, and *in actuality*. In the spirit of Gould and Lewontin (1979), we can further argue that semiotic scaffolding must necessarily also form ‘spaces left over’ that emerge from functional constraints and that are ‘filled’ (if at all) by the realization of some potential. Hoffmeyer pragmatically presumes that we must treat such possibilities as *real* – i.e., as a ‘cause’ of specifiable consequence; and he places this action central to the ongoing emergence of utterly novel being as a consequence of the function of semiotic freedom.

So too, Hoffmeyer’s “semiotic scaffolding” necessarily includes both those spandrels inherited by the constraints of semiotic function itself (post-physical universals – as it were), as well as those which arise from the ad-hoc nature of semiotic *synechism* – which are absolutely unique instances of being. In this, Hoffmeyer offers a usable framing of consequentiality (or pragmatic method) by which we might better pursue the *qualia* of lived experience. For as we ‘earn’ this freedom by ‘reading’ signs *as signs*, and not rush with our attention to their objects, so too, the recognition of the potential for future relatedness (which is always a ‘space left over’ within a semiosphere) results in a ‘free-er’ reconstruction of the present. The identification of semiotic spandrels may well loom large in intellectual history, cognitive development, evolutionary biology, and many other domains.

Returning to Peirce with striking regularity, Hoffmeyer seems always to begin in *firstness* – which is not so common as it may seem. Rather, it is generally considered that science begins with the object *with which* one studies (in the clash of secondness) – though many adhere to the archaic practice and begin with the object *that*

one studies (the stuff of thirdness). But in decades of published work, Hoffmeyer consistently begins with the potential adhered within some specifiable (i.e. falsifiable) circumstance of an organic being minding its surrounds – “regardless of aught else.” The ‘barrier’ (the ‘not’) that distinguishes the existence of a sensory (mental) quale begins the process of relating – which is a real beginning, and a way out of the nothingness of objects ‘in and of themselves.’ Moreover, this ‘way’ has a way of generating its own consequences – i.e., it is a nothingness that ‘stands’ for a somethingness, or a possibility that is also a mode of being.

It may well be that the chief difference between mankind and so-called *brutes* lies here, in the capacity of our ‘non’ sense – which is itself a consequence of the scale of the nothingness in which we are born, of which we conceive, and with which we are forced to operate. By this I mean that we engender, we are, and are in the engendering of, relatively impressive *nothing*. Yet too, as Hoffmeyer has well demonstrated, humans are biological organisms with semiotically realized mechanisms – which are of the same order as all the beasts, though the consequences of our particularities are of a vastly different scale. That he so cleanly but provocatively connects these normatively disparate notions is both a vital legacy and a very real possibility for future study.

Jesper Hoffmeyer’s biosemiotics is thus informed by the return to *nothing*, which is not merely non-existence but a discernable yet inchoate – a real but not actualized – potential for *furthered* existence. Such generative ‘non’ sense is built on a respect for the reality of not-yet existent ‘things’ and for the ‘spaces left over’. It is opposed by a return to ‘objects’ or even to the relational core of interaction – both of which build only on the continued syntax of *sense*. In this, Hoffmeyer’s approach to the heritage of previous interactions (i.e., biological objects) forever re-engaged in forever-immediate interaction, avoids both the Scylla of specious metaphysics and the Charybdis of naïve reduction, by emphasizing the generative power of life as biosemiotic habituation – in other words: life as it is actually realized, both sensibly and not.

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SPIRITUALITY

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*So we see a fundamental split in our perception of the self, the egocentric interior and the not-self or 'outside'... it is this split, this fundamental yearning, that endows the world with signification, that makes us desire it.*¹

For millennia, Western philosophers have defined 'meaning' in abstraction from the biological world. The world could be meaningful, the philosophers wrote, only if a purely spiritual agent, a *res cogitans*, were present. The flip side of this idea was equally problematic. Those who denied such dualisms felt compelled to become deniers of natural meaning altogether. Not to affirm a separate 'spirit' or 'soul', they argued, requires us to be nihilist, reductionist, physicalist, atheist, and so forth.

Jesper Hoffmeyer's proposal for solving the classical conundrum is a surprising one. He traces meaning-making back down the evolutionary ladder – beyond *Homo sapiens*, beyond the mammals, back to the origins of life. Even unicellular organisms, as Stuart Kauffman (1995) likes to say, are "out to make a living." Wherever an organism is "interpreting" its environment, Hoffmeyer argues, it is present as an "interpreter." And when that occurs, meaning-making is happening. Many of us believe that this semiotic approach provides the most powerful explanation of the most fundamental nature of biological systems themselves. Philosophically, too, it also may be the only way to break the hold of dualism.

¹ Hoffmeyer, Jesper 1996. *Signs of Meaning in the Universe*. Bloomington: Indiana University Press, p. 8.

When mind and meaning are artificially assigned to humans alone, our species is abstracted from its biological heritage. When biology is interpreted semiotically, by contrast, the evolution of culture and consciousness can be read without either dualism or reduction. For example, Hoffmeyer approvingly cites Peirce as being “able to construct a theory of meaning that explicitly includes the ‘inside aspect’, the experiencing, of mind processes” (2008: 11f). With such resources, the door is opened to interpreting science, philosophy, art, and religion both in their own terms, and as part of the natural evolution of meaning-making systems.

On this occasion, I would like to pose the question of how far we can take this insight. Can it offer us some guidance when we begin to explore traditional metaphysical and spiritual questions? As Hoffmeyer shows in *Signs of Meaning*, even empathy, the traditional foundation for love, plays an important role in a semiotic theory of subjects. Sometimes he even begins to employ the category of the “sacred,” only to pull back quickly to safer terrain.

Maybe now is the time to venture out onto the frightening sands of these classical questions, however, following the lead of Gregory Bateson’s *Angels Fear: Towards an Epistemology of the Sacred*. Could we speak of the emergence of “spirit” across evolutionary time? If ‘meaning’ is traceable back to the dawn of life, doesn’t that imply a sort of pan-psychism, permeating at least the entire domain of life? (A. N. Whitehead, the great pan-psychist and ally of Peirce’s, would also be an obvious ally here.) And are there not obvious parallels with concepts that are found in many of the world’s religious traditions – perhaps most naturally with the *dharma* traditions of India, with “co-depending arising” in Buddhist thought, and with the ubiquity of *ātman* (centers of interpretation) in the Hindu philosophies?

In the end, the semiotic approach to the evolution of meaning is further strengthened when its power to address the classical questions of metaphysics and spirituality is included within the conversation as well. The brilliance of Jesper’s biosemiotics, combined with the courage he has shown in taking on questions of meaning and value, make this final step a natural extension of the work he has already done.

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*Biosemiotics – a science concerned with the signs of life.*¹

Historically, semiotics and linguistics, on the one hand, and linguistics and biology, on the other, are so closely connected (via borrowings of models and metaphors, the use of similar or even the same schemes, concepts and terms, etc.) that it would be tempting, beginning *ab ovo* – that is, from the very first basic thesis – and following one of Jesper Hoffmeyer’s definitions of *biosemiotics*, to define *biolinguistics* in a similar way. Therefore, if *biosemiotics* is “a science concerned with the signs of life” (Hoffmeyer 2011a: 80), *biolinguistics* could be defined as “a science concerned with languages of life” – rather than “the study of the biology and development of language”, as it was declared, in particular, at the very first “biolinguistics conference” (1974), the participants of which manifestly understood *biolinguistics* differently... It would be particularly captivating, in the study of different “languages of life”, to put human “intellectual” language on a par with other “languages of life”, including, among others, the emotional (or the affective) one(s). As, however, almost every seemingly new concept is in fact an old but well-forgotten one, in the history of ideas, one can find the word *biolinguistics* in this very meaning.

Almost a century ago, in 1915, Swiss linguist Charles Bally (who was working at the time on the problems posed by *stylistics*, which he understood as the study of the emotional part of the human

¹ Hoffmeyer, Jesper 2011a. Biosemiotics – a science concerned with the signs of life. In: Skriver, Morten and Kjeldgaard, Inge Merete (eds.), *Livstegn. Kunst + biologi. Morten Skriver og Jesper Hoffmeyer*. (Katalog.) Esbjerg: Esbjerg Kunstmuseum p. 80.

language), wrote the following in a letter to his former Russian student Appolinaria Solovieva: “It would be better to avoid the term “stylistics”, because it is not quite clear [...]. It would be better to speak simply about the study of spoken emotional language. Sometimes I am inclined to introduce the term “biolinguistics” [*biolinguistique*] (“bios” life), assuming that the spoken emotional language is by nature closely connected with real life” (Bally, quoted in Fryba-Reber 2001: 126). Later, Bally preferred the term *stylistics* to *biolinguistics*; nevertheless, his initial “biolinguistic” intentions were implemented in a series of writings which considerably broadened the sphere of linguistic researches: earlier, the main domain of interest of the majority of European linguists was restricted to the study of “intellectual” language *par excellence*.

Therefore it was to a large extent thanks to *biolinguistics* (vs *stylistics*) understood as “a science concerned with one particular language (of life)” that linguists began to draw more attention to phenomena (for instance, interjections) which seemed to differ significantly from the majority of language signs (symbols) and whose systemic character was not so evident as that of other parts of the language. In this way, another layer was not only discovered, but also “officially recognized” in the human language – its “interior part that exists because it is defined through its contrast to its exterior” (Hoffmeyer 2011b: 81), reminding us once again of “the depth of the surface” of life (*ibid.*) and of its various signs, including linguistic ones.

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SUBJECTIVITY

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*Subjectivity has its roots in the cosmos and, at the end of the day, the repression of this aspect of our world is not a viable proposition*¹

One of the current pressing questions asked of biosemiotics is whether it is, principally, a biologization of semiotics, or a semiotization of biology. Notwithstanding the project's acknowledgment of the latter, which is dear to many biosemioticians – nor the idea that biosemiotics is *both* of the foregoing – I tend to consider the biologization of semiotics as being of key importance. My first acquaintance with biosemiotics in the 1990s, directly through my acquaintance with Thomas A. Sebeok himself, left me with the impression that biosemiotics was radically recasting the very bases of semiotics, the humanities and the social sciences. This impression was to be reinforced when I read Jesper Hoffmeyer's *Signs of Meaning in the Universe* (1996). Just before reading it, I had read another popular volume, Daniel Dennett's *Darwin's Dangerous Idea* (1996), and had been particularly impressed with the tough-nosed 'materialist' discussion, in the first hundred pages or so of the book, of how *matter* evolves into *mind*. Undoubtedly, Dennett, with his unforgiving Darwinism, seems a strange bedfellow for biosemiotics – especially since the latter has been very critical of the unequivocal mechanism of natural selection and has sought to uncover the significance of agency in nature. Yet, for a searching academic reader nurtured by the humanities in the 1990s, there was good reason to welcome both Dennett and Hoffmeyer.

¹ Hoffmeyer, Jesper 1996. *Signs of Meaning in the Universe*. (Haveland, Barbara J., trans.) Bloomington: Indiana University Press, p. 57.

For much of the humanities is self-obsessed, *pace* the development of ecocriticism, 'animal studies', posthumanism and the resurgence of zoosemiotics in recent years. In the Western academy in the early 1990s, driven by an academic publishing industry keen to milk a lucrative fad, 'postmodernism' largely dictated terms. Without spilling much more ink on this phenomenon, it can be largely dismissed now as the high point of an inward high-modernist collapse, in which the import of everything outside the Polis could be denied or disregarded or repressed in favour of a focus on the play of 'power relations' among humans in contemporary (read: Western) globalized society. In this scenario, questions about subjectivity – especially first-person experience – could, at best, be effectively bracketed or, at worst, attributed to the 'ghost in the machine' or found, as with all existence, to be entirely 'constructed in discourse'.

Dennett's discussion of matter-into-mind was so resolute, however, that it served as a powerful antidote to the vision of the world offered by 1990s postmodernism: a vision promulgated by the dwellers of a huge mansion who had not yet found their way out of the cupboard under the stairs to encounter the richness of the rest of the house. Yet it was Hoffmeyer's seemingly paradoxical assertion that "subjectivity has its roots in the cosmos" which was really striking. Dennett's discussion, in Darwinian fashion, demonstrated the Sebeokian axiom that 'culture is natural'. In general, this was to be expected: any educated citizen of the late 20th-century West (apart from religious fundamentalists) knows that humans evolved from an ancestor held in common with apes, and that that ancestor has its own ancestors. In evolutionary theory, something evolves out of something else. So with biosemiotics: the 'subjectivity' of lower organisms and the 'subjectivity' of humans are the respective something and something else.

Yet, I had never read anything about non-animal life that had ever asserted, with such conviction and poetry, that there is a continuity from the lower organism precursors to the most complex experiential phenomena in life. For me, Hoffmeyer's argument represented an alternative to both scientism and mechanism, on the one hand, as well as to both mysticism and postmodernism, on the other. Typically, Hoffmeyer – with his acute sensitivity to the socio-cultural consequences of ideas – had anticipated as much, when he

wrote that “while scientists may be averse to the idea that the natural world is populated by subjective and hence fundamentally unpredictable beings, humanists and theologians are just as averse to the concept of subjectivity being sullied by application to earthworms and seaweed” (1996: 43). It was a perspective which succinctly embodied the idea that ‘culture is natural’. It also seemed to represent true, non-partisan, progress in bridging the ‘two cultures’. Above all, though, it opened the door of the cupboard under the stairs and – for those who would venture out – it foreshadowed the traces and formations of the many delights to be found in the cupboard, offered clues to how those delights got there, and indicated the many associated delights that garlanded the rest of the house, and which had evolved to become concentrated under the stairs.

In Hoffmeyer’s short statement on subjectivity that I have reproduced above, one is able to see both the scholar and the man. There is the concern with that which is seemingly most human: subjectivity. The invocation of the cosmos – not ‘lower organisms’ or ‘primitive life’ – reveals a Peircean ambition in the realm of thought. The use of the idiom “at the end of the day” nicely indicates the commonplace nature of this fantastic assertion – and although they are technically the words of the translator, such English idioms pepper the work that Hoffmeyer has written directly in English.

Such ideas, too, fit in nicely with his recognition of ‘repression’ in the quote – for many scholars outside semiotics warn against navel-gazing and assume that simply proceeding with research is enough. Yet a great part of semiotics – and biosemiotics – is compelled to be concerned with how knowledge and much of the social world are riven by blindspots, *aporia*, and the denial of often the most commonplace features of the universe. Most recently, Claus Emmeche’s work (2011) has addressed such matters in penetrating fashion, and this endeavour needs to continue. Then there is the final phrase of the quote, describing the repression of the fact that subjectivity is rooted in the cosmos as “not a viable proposition”. This signals a future agenda, a pressing and massive one, for re-enchantment with the world. More personally, one can easily picture Jesper uttering this phrase, smiling wryly and apologetically at the same time, and shaking his head slightly. It is the

most forgiving of persuasive rhetoric. It is characteristic of the genius and the congeniality of the man.

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PROOF

SURFACES

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*We yet again encounter a plethora of biologically important surfaces [...] and across all of these membranes there occurs constant bio-semiotic activity.*¹

Hearing Jesper Hoffmeyer present these ideas at a colloquium at UCLA in 2001 led me to see, in a new way, pervasive phenomena that are central to the organization of action, language, bodies and tools within situated human interaction.

Many phenomena, across very diverse domains, are organized so as to bring semiotically charged surfaces with quite different properties into arrangements where relevant action (and knowledge) can be constructed through specific kinds of sign exchange processes. For example, participants systematically arrange their bodies into facing formations (Kendon 1990) – ‘ecological huddles’ that not only *frame* and make possible the exchanges of talk that occur within them, but also *position* each party to take into account and to operate on the embodied displays being produced by others. Talk within these arrangements is likewise organized through the juxtaposition of complex surfaces – for example: utterances organized into what conversation analysts call *adjacency pairs*.

Some of my own research has focused on Chil, a man left with a three word vocabulary – *Yes*, *No*, and *And* – after a stroke. Because of how his limited lexical items enter into sign exchange processes with other, more complex semiotic surfaces (both those in the environment and those currently being put in play by other meaning-

¹ Hoffmeyer, Jesper 2008c. The semiotic body. *Biosemitotics* 1(2): 169–190 (p. 175).

making participants), Chil is nonetheless able to act as a powerful speaker. By displaying opposition to what has just been said, for instance, the one word *No* – deployed just at that time, just in that context – transduces rich linguistic structure in the prior utterance in a way that Chil could not construct linguistically himself – while effectively transforming it publicly, so as to further his own meaning-making ends.

Thus, by virtue of the way in which his talk is lodged *within* the processes of an ongoing sign exchange across semiotically charged surfaces, Chil is not heard to produce an isolated single word, but to be objecting to precisely what was just said. Moreover, Chil can add other surfaces – such as expressive prosody, gesture, facial displays of stance, etc. – to the three words that he can speak. Through this continuous process of semiotic exchange across surfaces with distinct semiotic properties, Chil is able to produce highly varied, locally adapted action through talk, despite a catastrophically impoverished vocabulary (Goodwin 2010).

Other possibilities for consequential exchange and transformation emerge when tools with particular semiotic properties are incorporated into the organization of local action. Archaeologists, for example, classify the color of the dirt they are excavating by using a Munsell chart, an arrangement of color patches that scientists have constructed to rigorously and systematically describe color. Next to each color patch is a circular hole. To classify a sample of dirt, an archaeologist puts it on a trowel under the chart and moves it from hole to hole until the best match is found. The chart thus creates an architecture for perception: a surface with a window – which is to say, an *interface* – for the comparison of two distinct semiotic fields that, through operations on this new arrangement, transduces ‘dirt’ into ‘archaeological data’ (while at the same time incorporating into the surface constituted by the chart, a sedimented history of human work focused on the task of describing color).

Moreover, in many archeological excavations, two people use the chart to ‘classify color’ together. When one indicates a candidate classification by pointing to a particular patch on the chart, and the other moves the trowel with the sample dirt to the indicated hole, human action is being built through a complex cascade of exchanges across diverse semiotic surfaces, including: the dirt itself, the chart

with its holes, the finger pointing to a specific place on the chart, the responsive movement of the trowel as an interpretant of the immediately preceding action, etc. Through such endlessly enacted exchanges across this plethora of semiotically charged surfaces, archaeological data, action and knowledge are systematically constructed. Countless other examples can, of course, be provided.

In brief: Participants in human interaction build action conjointly, by organizing their sign exchanges across diverse semiotically charged surfaces. Investigation of the practices used to accomplish this allows a range of apparently quite distinct phenomena – talk, co-operative action, postural configurations creating participation frameworks, gesture, tools, the structure and classification of a consequential world, and the ways of knowing and acting that are as central to science-as-practice as they are to the hopscotch games of children (Goodwin 2000), etc. – to be investigated as integrated components of the endogenous semiosis used to build human activities and communities. Jesper Hoffmeyer's vivid insights into how surfaces with different properties organize action through diverse, consequential, semiotic exchanges offers us powerful new resources for understanding the *in-situ* organization of human action.

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SYMBOLOSPHERE

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*Language has, as it were, its own independent existence – almost as if it, too, had something on its mind.*¹

Jesper Hoffmeyer has introduced an important concept in his 1996 volume, *Signs of Meaning in the Universe*. This concept is the *symbolic semiosphere* which we have named the *symbolosphere* (Schumann 2003; Logan; Schumann 2005).

The term refers exclusively to those signs-of-signs relations that can create things that do not exist in the biological and physical worlds. These things are often ideas and ideologies. Yet in spite of the fact that these things are essentially non-physical, (i.e. they cannot be indexed by pointing), they can and do powerfully influence our lives.

Currently, there is a strong aversion among scholars to dualism – or at least to the aspect of dualism in which the mind is seen as being separate from the brain. Here I would like to reassert dualism – but in a new way. Ideas and ideologies are generated in an individual's brain and then – among humans who have the powerful communication system, language – the idea is distributed to other brains where it can be elaborated and spread to still more brains. Brains interacting with language generate the emergence of non-material constructs that influence our lives as powerfully as does the biosphere and the physisosphere.

I am suggesting that these emergent constructs (e.g., religion, rule of law, attitudes towards violence, love, democracy, political

¹ Hoffmeyer, Jesper 1996. *Signs of Meaning in the Universe*. (Haveland, Barbara J., trans.) Bloomington: Indiana University Press, p. 98.

ideas, and culture writ large) cannot be traced to regions or circuits in the brain. They are not in the brain nor are they of the brain, but nevertheless, they are served by whatever mechanisms of the brain they can colonize, co-opt reuse, and inhabit. They are products of brains that are capable of creating purely symbolic constructs. They have independence from the brain and cannot be reduced to neural tissue, nor its firing. I suggest that they are, in fact, what constitute the *mind*. This is the basis of the new form of dualism that we are proposing – this nonmaterial mind is independent of the material brain (or brains) – and because many brains interacting are required to produce minds, one human's mind cannot be inside, or be the product of, that human's brain.

Some have objected to this assertion of dualism because it maintains that brains are required in order to have minds. Minds, on this perspective, are usually seen to arise from interaction among brains *via* language – and the non-material ideas, thoughts, and constructs that are created are then processed, learned, and remembered by brains. But since the ideas that emerge from interaction among brains only exist within (and because of) a powerful symbolic system (i.e., language) that represents them, ideas are essentially free from the body/brain while, at the same time having downwardly causal influence on brains, minds, and behavior.

For example, the former Catholic prohibition against eating meat on Friday powerfully influenced many people's lives, but it left other people's (non-Catholics) lives unaffected. So does that mean the unaffected individuals lacked a neural mechanism for avoiding meat on Fridays, and when someone converted to Catholicism, did they acquire that mechanism – or engage one that was latent? No, the idea, the rule, the injunction against eating meat existed independently of the brain as part of a non-material mind that, after Jesper Hoffmeyer's pioneering work, I, in my own work, refer to as the *symbolosphere*.

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SYMPATHY

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*Semiotic complexity or semiotic freedom as I choose to call it [...] is a measure of the depth of meaning communicated or interpreted by living systems.*¹

The idea of semiotic freedom, as the general expansion of the semiotic (meaning-making) capacity of evolutionary life on earth, is central to any discourse in biosemiotics. This entails the argument that living organisms, from the most simple to the most complex are sign-making and sign-receptive creatures. Interestingly, this continuity between the natural and the cultural world through the idea of semiotic freedom was prefigured in the nineteenth century by the Victorian writer George Eliot (1819–1890) who articulated the link between nature and culture through her concept of sympathy which stemmed from her organic understanding of the natural world and its application to the interpretation of aesthetic practice as advocated by German Romanticism.

At the heart of German Romantic philosophy lay the idea of the re-animation of nature which emphasized the shift from a mechanistic to an organic model of the natural world. This conceptual shift meant that reason alone could no longer provide a sense of the meaning of nature for the individual subject hence, by the end of the eighteenth century, the “highest act of reason” was proclaimed as “an aesthetic act” (Hölderlin 1796: 155). The importance of art as a medium for the interpretation of nature had been advocated by many, for instance Kant, Schelling and Goethe in Germany, Wordsworth

¹ Hoffmeyer, Jesper 2010. A biosemiotic approach to the question of meaning. *Zygon* 45(2): 367–390 (p. 377).

and Coleridge in Britain, all of whom shared the idea that what had been repressed by reason could be rearticulated through aesthetics. The emphasis thus put on aesthetics initiated a way of thinking about nature's creativity and human creativity in art as being related and interdependent. Most importantly, it postulated the possibility of exploring the spiritual, psychological and ethical implications of nature as embodied.

The influence of German Romantic philosophy is evident in Eliot's understanding of art and its form. She asserts that art 'is the nearest thing to life' (1992a: 264), meaning that traditional forms of art which are bound to strict rules of representations cannot represent the complexities of human experience and thought adequately, but these complexities can only be explored through an organic understanding of a work of art. She defines literary form as "wholes composed of parts more and more multiplied and highly differenced, yet more and more absolutely bound together by various conditions of dependence" (1992b: 356). In other words, the form shows how something is related to its environment.

For instance, Eliot believed that if she were to describe a flower, she could not only provide a visual description of what it looks like, as that would not constitute its form. Instead, she felt she would be bound to describe the flower in relation to the soil and the soil in relation to the grass and so on. In this respect, the literary form does not then depend on the outward appearance, i.e. physical description of things, but it depends on its inward relations, which could grow in complexity, thus producing a higher form of art. The highest example of form would thus be "the highest organism, that is to say, the most varied group of relations bound together in a wholeness, which has the most varied *relations* (my italics) with all other phenomena" (1992b: 356).

Thus, for Eliot, the novel as a form of art is organic and its complexity does not lie in the number of characters present, but in the complexity of their relations which are semiotic in nature. She postulates the human ability of sympathy defined as "a mode of amplifying experience and extending our contact with our fellow men beyond the bounds of our personal lot" (1992a: 264) as a method for the adequate interpretation of the varied relations and psychological complexities of the characters in her novels, as well as being the necessary condition for a moral agent.

Morality, in Eliot's view, grows from the ability to imagine another's state of mind or the ability to interpret signs; in *Middlemarch*, for instance, she describes the young, progressive doctor Tertius Lydgate as being known as "merely a cluster of signs for his neighbours' false suppositions" (Eliot 1994: 140). Eliot's fiction is fundamentally based on the importance of extending our sympathies, or rather – and perhaps much in the spirit of Jesper Hoffmeyer, also – on the importance of making us think about extending our semiotic freedom by reading the signs of each other more carefully, thus ethically.

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SYNTHESIS

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*Biosemiotics: Towards a New Synthesis in Biology*¹

The conventional version of evolutionary theory – the central theoretical framework of the biosciences known as the Modern Synthesis – is now more than 70 years old, and calls for its revision have come from many directions.

On the one hand, a number of research areas within the biological sciences have established new concepts and models that pertain to evolutionary factors beyond genetics, such as niche construction, non-genetic inheritance, facilitated variation, epigenetic innovation, etc. – all which demand an expansion of the standard framework. On the other hand, proponents of fields outside of empirical biology have criticized the framework of the Modern Synthesis on theoretical grounds, foremost from the perspectives of philosophy of biology and semiotics. An increasing number of workshops, symposia, books, and research articles attest to the fact that evolutionary theory is undergoing a period of ferment, and, despite inevitable resistance from traditionalist quarters, there is unprecedented openness for re-thinking some of the key assumptions of its pervasive paradigm.

Jesper Hoffmeyer has been an untiring critic of the received theory of evolution, arguing against its reductionist stance, its gene-centrism, and its overt omissions. In several of his publications (1996; 1997; 2008), Jesper reveals the essential shortcoming of thinking about evolution solely in terms of variation and selection,

¹ Hoffmeyer, Jesper 1997. *Biosemiotics: Towards a New Synthesis in Biology*. *European Journal for Semiotic Studies* 9(2): 355–376.

and, more clearly than others, he points out that evolutionary theory has been severely hampered by its deterministic, instructive, program-like view of genetic information. Exposing the information-theoretical fallacy of the deterministic position, he argues that rather than the genetic signals themselves, the evolution of the interpretative component of signaling should be given primary attention (*ibid*). Without the inclusion of such biological sign study, Jesper sees no possibility for a comprehensive explanation of the genotype-phenotype relationship. (His view, moreover, receives support from current EvoDevo research demonstrating the widespread occurrence of developmental drift in the face of extensive conservation of regulatory sequences and signaling pathways in disparate organismal lineages).

Jesper's own proposal, that of a Semiotic Synthesis, is more than just a new theory about evolution. Rather, it aspires to lay the foundation for a unified theory of biology – based on rules of communication – spanning physiology, ecology, behavior, and evolution. *Semiotic ordering* is seen as a key principle in all these aspects of life and, hence, as a good starting point for building a unifying approach. While semiotics may not replace the Modern Synthesis theory any time soon as such – since at this point it remains abstract and does not offer the working biologist any practical tools for addressing and testing empirical problems of organismal evolution – it will certainly contribute to a more pluralistic conception of evolution. Indeed, many arguments from semiotics coincide with proposals for an expanded theoretical framework emerging from behavioral and cognitive biology, evolutionary developmental biology, ecology, but also from genomics and epigenetics. The multiple overlaps among these proposals, despite their independent starting points, all emphasizing a more systems-oriented, multicausal, multi-level view of evolution, make the argument for a revision of the standard model even stronger.

In two areas, the conceptual overlaps are particularly striking. One is emergence. In contrast with the traditional view, most alternative proposals emphasize that evolutionary change is not merely gradual and continuous but also involves rapid and discontinuous forms of change, due to the inherent emergent properties resulting from the interacting levels at which evolution takes place. Whether emergence is detected in molecular, developmental, behavioral, or

communicative systems, it suggests a dynamics of evolution that is no longer explainable by the paradigm of steady, incremental, variational change on which the Modern Synthesis was based. The different new approaches agree that a causal explanation of evolving life must include the principles of emergence that pertain at different levels of organization, semiotics being one of them.

A second overlap concerns the non-genetic stabilizing processes that must coincide with emergent forms of change. Genetic fixation of emergent traits is slow, various other forms of stabilizing agencies have been suggested to intervene, at least for a period of temporary maintenance during which natural selection can act, potentially leading to genetic fixation. EvoDevo proponents speak of epigenetic integration or accommodation, ethologists know various forms of behavioral and cultural fixation, philosophers of science evoke scaffolding processes, Jesper introduces the concept of *semiotic scaffolding*. By this he means that new traits or behaviors would be initially stabilized through semiotic feedback loops and would thus be kept functional for many generations or even for indefinite periods of time. The same has been argued for more direct forms of non-genetic stabilization, such as epigenetic integration, in which the plasticity of developmental systems to react to local cues may functionally accommodate a new trait. Traits that depend on epigenetic integration can be maintained for millions of years in the absence of direct genetic fixation, but they disappear when the epigenetic cue is removed.

None of this is thought to happen outside the classical mechanisms of population level evolution, such as genetic variation, differential reproduction, and natural selection. But it is clear that many of the factors that were not part of the orthodoxy have a decisive influence on the direction and the outcome of selectional processes. Any comprehensive explanatory framework of evolution will have to take these factors into account. It has become evident beyond doubt that natural selection is not the only, and maybe not even the most important, factor in the explanation of the biological world. Jesper Hoffmeyer has seen this early on.

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TELEODYNAMICS

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*Thus, from the modest beginnings, we saw in chemotactic bacteria, the semiotic freedom of organic systems would have tended to increase, and while it has not been easy to prove that any systematic increase in complexity, as this concept has traditionally been defined, has in fact accompanied the evolutionary process, it is quite obvious that semiotic complexity or freedom has indeed attained higher levels in later stages, advanced species of birds and mammals in general being semiotically much more sophisticated than less advanced species.*¹

In the article from which the above quote was taken, Jesper Hoffmeyer writes: “This inversed arrow of time (future directedness) immediately sets *functions* apart from other kinds of mechanisms that always refer backward along some chain of causation [in] explaining how the feature occurred”. I believe this to be the crux of the issue, as humans conflate function, sign-making processes (semiosis and biosemiosis), and conscious or “purposive” processes (Sagan 2011). Kant, in the *Teleology of Judgment*, showed that teleology (like causality, space and time) is a mental category that we bring to the world. Indeed, it is not so easy to distinguish *consciousness* from this kind of “future directedness [that] immediately sets functions apart from other kinds of mechanisms [that instead] refer backward along some chain of causation” –“mechanisms” here referring to phenomena such as natural selection and Newtonian-style action-reaction.

¹ Hoffmeyer, Jesper, 2010. Semiotic freedom. In: Davies, Paul; Gregersen, Niels Henrik (eds.), *Information and the Nature of Reality: From Physics to Metaphysics*. Cambridge: Cambridge University Press, 185–204 (p. 196).

In fact, in my articulation of what I called “Turing Gaia,” I show that global thermal regulation – a “Gaian” phenomenon dismissed as demanding ‘consciousness’ or ‘communicative purpose’ by leading neoDarwinians – is simply a consequence of growth within a temperature range. Since such growth was modeled on a computer, I argued (Sagan 2010) that these scientists, for whom genuine future-directed behaviors break the biological taboo against teleology, had in essence been fooled into thinking a computer was conscious. Moreover, the author of the computer model, James Lovelock, interpreted telic global physiology by introducing natural selection into later versions of Daisyworld (Sagan; Whiteside 2004). Yet the model requires no natural selection to respond purposively; the planetary thermoregulatory behavior – the opposite of garbage-in-garbage-out computer programs – comes from the quite reasonable assumption that white and black daisies will grow and die back dependent upon temperature. Because they reflect and absorb light, this responsiveness to increasing solar luminosity permits them to thermoregulate Daisyworld by altering its albedo.

The “sleight-of-hand” here is that teleology has been slipped in with the sensitive (read: semiotic) tendency of flowers to grow only within a specific temperature range, or gradient. While it may be anathema to biosemioticians to extend sign-making behaviors beyond the realm of the living, consider the evidence: Non-living complex systems such as hexagonal-shaped thermal convection cells, intricately changing chemical (e.g., Belousov-Zhabotinski) reactions, and typhoons multiplying over the Pacific also originate, maintain, and grow only within gradients (that they implicitly – and semiotically – sense). The differences are in temperature, chemical concentration, electron potential, and barometric pressure. Hurricane wind speeds, part of cyclically organized storms (to which humans, granting kinship, give first names), are directly correlated to atmospheric pressure gradients.

Whether we like it (in the sense of finding it flattering to our vaunted sense of human specialness) or not, such behaviors, whose natural teleology (or purpose) is to reduce ambient gradients, are genuinely *future-directed*. The mystery of “Turing Gaia” is that, though we would be loathe to grant all gradient-reducing systems the property of being conscious, they are as genuinely future-directed as are we. Indeed, Prigogine and Stengers (1984) have

pointed out that disparate parts in nonequilibrium thermodynamic systems behave as if they were “communicating”. I would add that they also appear to be doing so toward a common end. This is future-directedness, function. But, *contra* Kant and modern self-organization theorists, such future-directedness does not so much “emerge” as *inhere* in the fundamental telic nature of energetic matter, as described by thermodynamics’ second law (Fernandez 2011).

Energy, if not hindered, spreads. This spread, measured by the conceptually abused quantity *entropy*, is simply the observed behavior codified by the second law of thermodynamics (which can also be described as ‘nature’s tendency to reduce gradients’) – the very behavior that is naturally teleological, and mistaken for conscious purposiveness (Schneider and Sagan 2006). Moreover, contrary to those from Daniel Dennett (1995) to Pope Pius VII, naturally appearing complex thermodynamic systems do not “violate” the second law, but produce *more* entropy than do non-organized systems. Growing life does so more efficiently, but joins non-living complex systems in its sensing of external gradients and exploiting them for their energetic potential. Telic behavior is implicit in thermodynamically described matter-energy configurations which naturally tend toward equilibrium, and by implicitly semiotic complex systems that maintain their boundaries and activities until they are finished degrading the energetic gradients that they detect, within their capabilities.

The notion that “it has not been easy to prove that any systematic increase in complexity ... has, in fact, accompanied the evolutionary process” can, I think, be laid at the foot of the same “teleo-taboo” that leads us to conflate end-directed, gradient-reducing processes with conscious purpose – this latter granted only to deity and humanity since Descartes. In other words, while the natural telic tendency of energy to spread naturally confers future directedness upon evolution as a whole, evolutionists as distinct politically as Richard Dawkins and Stephen Jay Gould both err (and unintentionally provide fuel for creationists by ignoring clear evidence) when they characterize evolution as an essentially random process – a characterization due not to evidence or investigation, but to a knee-jerk dismissal of teleology, because to them it smacks of deity.

Taken as a whole, life shows measurable increases in number of individuals, species, and taxa; in bacterial and animal respiration efficiency; in number of cell types; and, despite periodic setbacks from mass extinctions, in global biodiversity, connected sentience, and, we might add, “semiotic freedom.” Using living representatives of animal groups and plotting a curve according to the order in which their groups appeared in the fossil record, Russian scientist Alexander Zotin (1984) quantified a striking trend toward increase in oxygen efficiency over geological time. Another Russian scientist, Vladimir Vernadsky (1998) pointed out that ever more chemical elements in the Periodic Table have become incorporated into biospheric processes over evolutionary time. Measured as ergs per second per gram and adjusted for mass, complex systems score higher rates of energy flow as they’ve evolved from galaxies to stars, biospheres, reptiles, mammals, brains, societies, and computers (Chaisson 2001).

Although there is no space left here to analyze agency, I wish to note that for Spinoza a stone, if it were aware, would think that it flew of its own volition. Similarly, organisms may be seen as complex instruments, unaware of the roots – both causal and telic – of their own behavior. Thus to conclude, the semiotic freedom that Jesper Hoffmeyer rightly posits to be on the rise over evolutionary time can be understood in terms of the telic tendencies of matter-energy in a thermodynamic cosmos, one in which advanced signaling systems such as those seen in sentient life allow for greater possibilities of more stable, efficient, and powerful ways of leveling ambient gradients.

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TERMINOLOGY

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*It seems as if modern biochemistry cannot be taught – or even thought – without using communicational terms such as ‘recognition’, ‘high-fidelity’, ‘messenger-RNA’, ‘signalling’, ‘presenting’ or even ‘chaperones’.*¹

This observation – which Hoffmeyer has made on a number of occasions, sometimes together with Claus Emmeche (1991) – occurs to me as being extremely important to the whole project of bio-semiotics as a scientific program.

Biosemiotics, it is true, has other strong argument bases. A priori arguments stemming from general philosophical sources such as Peirce’s semiotics, or from theorists of biology like Jakob von Uexküll, also form important blocks of arguments pertaining to the formal ontology and the regional ontology of biology, respectively – but Hoffmeyer’s observation connects these ideas, importantly, to the whole of modern biology and its dependence upon biochemical findings. The quote continues as follows:

“Such terms pop up from every page of modern textbooks in biochemistry in spite of the fact, that they clearly have nothing to do with the physicalist universe to which such books are dedicated.” (ibid.)

The observation that semiotic concepts are ubiquitous in biochemistry textbooks can easily be generalized to all of modern biology, ranging from molecular biology and to ethology and ecology: semiotic concepts of many sorts appear on every level of

¹ Hoffmeyer, Jesper 2010. Semiotics of nature. In: Cobley, Paul (ed.), *The Routledge Companion to Semiotics*. London: Routledge, 29–42 (p. 32).

biological research. This crucial observation is what takes bio-semiotics away from being armchair speculation only. It directly addresses a central conceptual problem in the institutions of biology. Thereby, it commits biosemiotics to monitor ongoing conceptual developments in empirical biology.

The importance of such a procedure has been indicated by Ernst Cassirer, who never wavered from his important principle that philosophy must stay connected to the ongoing evolution of the special sciences – from physics to art history, from mathematics to the science of religions. The conceptual innovations taking place in such sciences must be a primary aim for the philosopher of science to compare, clarify, explain, and make coherent.

Regarding biology in particular, Cassirer followed his own advice in the beautiful and overlooked chapter on the epistemology of biology in *Das Erkenntnisproblem* Vol. IV – arguably one of the most important texts of 20th century philosophy of biology – which covers the development of pre-Watson-and-Crick biology up until the time of the chapter's writing in the 1930s.

Many biologists, it is true, may respond to Hoffmeyer's observation (and Cassirer's principle) by saying that notions such as *information*, *code*, *signal* and *communication* in biology are mere metaphors or shorthands for underlying physical processes. The immediate counter-reply would be, then: Why not dispense with such "shorthands" in order to say things as they really are?

Physics, by contrast, has little need to use semiotic vocabulary to the same extent as does biology. The immediate suspicion is that semiotic vocabulary in biology is there because it serves a real purpose – because it refers to processes which may be physically instantiated in a high number of different fashions, but which retain a formal and functional unity on the higher, biological level of organization which makes concepts referring to such unities indispensable. They refer so because semiotic processes are thus really taking place, calling for a semiotic description.

Hoffmeyer's basic claim is that this makes it necessary to take seriously the pervasiveness of semiotic concepts in biology. Such concepts should be taken as technical terms and not as colloquial expressions only. But taking such terminology seriously is no easy matter. To develop semiotics to a technical level where such concepts acquire a more precise meaning is no mere matter of

definition – it is connected to deep issues in theoretical biology and to the underlying philosophy of science more generally.

In short, this is a major goal of the whole current of biosemiotics – of which Jesper Hoffmeyer counts as one of the founding fathers.

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TERTIUM DATUR

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*Allowing for semiotic freedom in the organic world significantly changes the task of explaining emergent evolution, because semiotic freedom has a self-amplifying dynamic.*¹

What is semiotic freedom and why do we need this notion? I will answer these questions in a roundabout way, by first asking another question: What is the nature of the general problem that Hoffmeyer addresses with his notion of semiotic freedom?

In relation to modern biology, Hoffmeyer suggests that his biosemiotic approach can show us a way to steer between the Scylla of the modern, gene-centered proponents of Neo-Darwinist orthodoxy and the Charybdis of the religiously inclined proponents of “intelligent design”. In Hoffmeyer’s view, there is an alternative that avoids *both* the scientific notion of determinism *and* the religious notion of fate/God’s will. Both alternatives adhere to the notion of something inevitable. Hoffmeyer’s point is that evolution is open-ended, and that this runs counter to all notions of a determinate end. Thus, Hoffmeyer offers his *tertium datur*: the biosemiotic perspective and the notion of semiotic freedom.

As an intellectual historian concerned mainly with the history of contemporary philosophy, I cannot but think that the problem that Hoffmeyer is focusing on is a version of the Kantian problem of

¹ To my knowledge, Jesper Hoffmeyer presented the idea of semiotic freedom in English for the first time in his essay “Some semiotic aspects of the psycho-physical relation: The endo-exosemiotic boundary” (Hoffmeyer 1992). I first became acquainted with this idea in his book *En snegl på vejen* (Hoffmeyer 1993). The quote is from Hoffmeyer 2010: 196.

“nature and freedom” – which is to say that it is a metaphysical problem – and in my opinion, Hoffmeyer’s biosemiotic approach brings us one step further in the direction of an understanding of the emergence of freedom in nature. At the general level, then, Hoffmeyer contributes significantly to the task of overcoming the dualistic models of thinking that we have inherited from the modern tradition that extends from Descartes to Kant, and that stretches further beyond them, i.e. into the tradition of modern scientific thinking. As I see it, he does this with his notion of *semiotic freedom*, which aims at a bio-semiotic overcoming of the split between nature and culture. From my point of view, then, Hoffmeyer thus bypasses the “human, all too human” tendency to situate the problem of freedom unilaterally within a “philosophy of praxis” – which is what 20th century philosophy has been inclined to do, whether is was in its “materialistic”, “naturalistic” or “linguistic” form.

What is more, the notion of semiotic freedom makes it possible to do different kinds of multidisciplinary semiotic research into the emergence of freedom in nature, holding empirical facts before our eyes, but without the obligation to present our results within the logic of causal explanation. Instead, we have recourse to a logic of forms, i.e. a logic that deals with parts and wholes (totalities), which can do without a definite teleology. This logic of forms relieves us from any burden as to the necessity of this or that identifiable vector in the logic of the “straight line” – a line which always leads us into the impasse of determinism. Instead of simply speaking of teleology, Hoffmeyer speaks of “teleodynamics” – which allows for freedom in nature – i.e., semiotic freedom.

The notion of semiotic freedom is about the progressive self-liberation of the semiosphere by way of processes in which both genealogical or *vertical semiosis* and ecological or *horizontal semiosis* are integrated into increasingly complex systems. The increase in semiotic freedom, which comes as a result of this progressive self-liberation of the semiosphere, does not primarily refer to the increasing multitude of semiotic processes in general – i.e. to a quantitative growth in semiotic processes – but rather, to changes in the *qualitative* aspect of semiotic processes as such: An increase in semiotic freedom carries along an increase in the richness or *depth in the meaning that the semiotic system is able to*

communicate. Hence, Hoffmeyer tentatively defines semiotic freedom as that “depth of meaning” (Hoffmeyer 1993: 91).

From the point of view of the history of ideas, then, there are three main ideas that Hoffmeyer extends and contributes to with his biosemiotic approach and his notion of semiotic freedom. Firstly, there is the idea of spontaneity, i.e. the idea of an active and creative force in nature, which emerges in the human being as an essential part of being human, but which is also prevalent in living nature as such. Hoffmeyer's contribution is philosophically stimulating in that he opts for a perspective that does not see the human being as the exclusive site of this freedom.

Secondly, Hoffmeyer advances the idea that even though the parts contain the whole in themselves, there are more to the whole than what the parts are able to display. It is in order to think this “more” that we need holistic conceptions about emergent properties and systems. In this respect, from my perspective as an historian of 20th century philosophy, Hoffmeyer's contribution is rewarding in that he connects this idea to the problem of life and not solely to the problem of language and/or praxis.

Thirdly, Hoffmeyer is able to put into perspective the meta-scientific problem of how the life sciences are supposed to account for their own perspective and presuppositions: In general, one cannot utilize the scientific language of this or that scientific discipline, in order to account for the meaning of the results of this or that discipline, without running into the problem of self-reference. Hoffmeyer neatly explains to the reader how this is a problem for every living creature, and how the problem becomes importunate for us as human beings – no small merit!

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TRIADICITY

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*Nothing in biology makes sense except in the light of information.*¹

Jesper Hoffmeyer's work has transformed our understanding of biological processes. He has done this by developing several basic premises of Peircean semiosis within his own examination of biological dynamics. He began with the observation that life is not random, but exhibits obvious continuity of types. How can this be? After all, as he says, "in principle everything is forgotten once it dies" (1996: 13). But continuity of type is a reality, and therefore "the essence of procreation lies in a principle which we will call coding – or, even better, *semiosis*" (1996: 13). To explain this, Hoffmeyer sets up several basic axioms.

First, is his acceptance that biological reality is an informational reality. That is, organic matter is not simply inert-mass-pushed-around-by-other-mass. Rather, it is self-organized within principles of information – understanding that term to mean 'knowledge of something' and which includes an awareness of the distinction between self and other. His analysis of biological organisms as informational systems means that he defines biological processes as semiotic – which is to say, as making and using 'signs'. To achieve this analysis, he specifically rejects the Saussurian dyad, or linear triangle model of the sign, where a mechanical Observer-Agent merely substitutes 'this meaning' for 'that object' Hoffmeyer

¹ Hoffmeyer, Jesper 2010. Semiotic freedom: An emerging force. In: Davies, Paul; Gregersen, Niels Henrik (eds.), *Information and the Nature of Reality: From Physics to Metaphysics*. Cambridge: Cambridge University Press, 185–204 (p. 187).

chooses instead to use the Peircean model of the sign: a relational triadic process made up of three interlocked relations that resemble the spokes of a wheel (1996: 17–22). In other words:

not this:



but this:



Here, one can see that the linear triangle as a morphology (shape) is an isolate form, with its three nodes or points-of-meaning connecting only to each other – and thus requiring an external agent to kinetically move ‘this object’ to ‘that meaning’. The Peircean triad, on the other hand, sets up a morphology that is both self-organized and relational. Each spoke or relation is able to connect to myriad other spokes and relations, and thus the biological organism that operates in this informational mode actually operates as a complex interconnected network.

Following this outline of biological reality as an interactive informational process, Hoffmeyer then explores it further. He examines the nature of that triad of relations and accepts the Peircean analysis that reality both ‘takes normative habits’ – and also that reality allows for ‘freedom’ or ‘anarchy’ and thus, the emergence of novel inventive modes of existence (1996: 27). One relation focuses on acknowledging and maintaining ongoing commonalities within the self and with other biological systems; another relation focuses on acknowledging novelties; another relation on developing profitable reactions to these novelties (1996: 21–24). These three relations provide different ontological capacities: both stability and adaptive novelty are self-organized within informational interactions with the environment. Thus, Hoffmeyer concludes that “living creatures are self-referential, they have a history, they react selectively to their surroundings, and they participate in the evolutionary incorporation of the present in the future” (1996: 51).

These basic premises enable us to understand the biological realm as, not mechanical, as it is within the neo-Darwinism paradigms of pure random changes and ‘might-makes-right’ results of Natural Selection, but as a complex informational process, wherein the biological realm operates, as described by Peirce, as a rational process – and thus takes functional charge of its existence. The perspective that the biological realm is an informational realm

means that the organism is capable of future-oriented, predictive and self-controlled interactions with its environment, rather than being limited to strictly mechanical and reactive action. How does this realm operate? We return to the semiotic triad.

As Kull *et al.* (2009: 168) state, the biological realm operates as a function – “a process organized around an implicitly represented end”. The Peircean triadic sign can be analyzed as the function of $f(x)=y$, acting as a single morphological reality. This simply means that a normative rule, f , is examining the input data, x , informationally, so as to enable the system to anticipate the effects of that data on its nature, and to develop itself to constructively interact, y , with the environment (Taborsky 2006; 2008).

These basic principles, based on Hoffmeyer’s unique application of Peircean semiotic analysis to the field of biology, result in a perspective of biological processes that includes a self-controlled continuity of type – in other words, an “inherent intentionality of biological information” (Hoffmeyer 2010) – i.e., a self-organized adaptive flexibility to environmental stimuli and evolving interactional informational relations.

The results of the use of semiosis or informational processing within the biological realm are far-reaching and – as in diffusion – this new approach is spreading, directly and indirectly. I can refer to a 2011 paper by Garzon and Keijzer that claims that “plants exhibit intelligent behavior, that they have ‘root-brains’ (see also Hoffmeyer’s ‘floating brains’ of the immune system, Hoffmeyer 1996: 87) and that they possess internal control structures in many ways functionally similar to neuron-based control structures” (Garzon, Keijzer 2011: 155). Thus, “plants can be considered to be minimally cognitive and [...] they constitute an important domain for cognitive studies” (Garzon, Keijzer 2011: 156).

Or, to repeat Hoffmeyer’s words: “nothing in biology makes sense except in the light of information” (2010: 185).

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TYCHE!

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Apparently real systems do not have formal origins; formalizations become possible only after realizations, never before. Thus the need for deterministic causation fades away and it becomes more plausible to see irreversible time as a real phenomenon. Something just happens in evolutionary systems that no formula could have predicted and this strongly supports the conception of chance fluctuations as an ontologically real aspect of our universe. The combination of chance fluctuations and chaos dynamics can be seen as responsible for the making of history in the true sense of this word as a unique and unpredictable series of temporal events at a macro-scale.¹

We wholeheartedly share Hoffmeyer's opinion in his opening sentence, which necessarily makes these emerging realizations the true objects of interest. Later in the same paper, Hoffmeyer invokes a quotation from Peirce that begins: "Uniformities are precisely the kind of fact that need to be accounted for. [...] Law is *par excellence* the thing which wants a reason" (CP 6.12–13) and which exhibits great parallelism to Simondon's approach to 'the individual': "It is the individual, as a constituted individual, that is the interesting reality, the reality that must be explained" (Simondon 2009: 4).

The French philosopher Gilbert Simondon (1924–1989) wrote on a very similar track to C. S. Peirce about the real nature of ontogenesis (which he examined in great detail under the general title of

¹ Hoffmeyer, Jesper 2006a. Genes, development, and semiosis. In: Neumann-Held, Eva M.; Rehmann-Sutter, Christoph (eds.), *Genes in Development: Re-reading the Molecular Paradigm*. Durham: Duke University Press, 152–174 (p. 155).

individuation) as a process starting from the physical, reaching through the biological and psychic, to the collective domains.

For Simondon, ontogenesis begins and continues with the process of individuation, and the individual constitutes only a result (or a phase) of it. He criticizes earlier philosophical quests for a ‘principle of individuation’ which governs this process right from the beginning, with the argument that a principle itself *is* an individual, hence it cannot precede the process that will give birth to it. Indeed, both “formalization” – which Hoffmeyer places necessarily after realization – and “uniformity” or the “law” which Peirce wants to explain, can be considered as “individuals” in Simondon’s broad sense. Agreeing on the apparent unpredictability of real systems that persists along with the apparent regularities in nature, the metaphysical question of the source of this unpredictability remains as the main issue.

Alberto Toscano, in his comparative work on theories of individuation summarizes Peircean cosmogony as follows: “In the final analysis, Peirce’s concern is with the genesis of regularity. Arguing that mechanical laws that suffer no exceptions are unable to account for the diversity of phenomena, and *a fortiori* for their own functioning, Peirce posits both a chance beginning (*of* the evolution of laws) and a continuous irruption of chance (*into* the evolution of laws). This is the core tenet of the doctrine he dubs *Tychism*” (Toscano 2006: 125).

Toscano then draws our attention to the words of the eminent Peirce-scholar, Karl-Otto Apel: “[...] the principle of individuation is subordinated by Peirce to a ‘principle of absolute, creative spontaneity or possibility, without which phenomena like variety, heterogeneity, differentiation, specification, and growth cannot be explained’ ” (Toscano 2006: 135). Peirce, without the aid of the scientific developments yet to come, particularly that of chaos theory and theory of open systems, seems to have had no other choice than resorting to “chance” as an explanation for the unpredictability and creative spontaneity in nature.

Yet more than half a century after Peirce, chaos theory has demonstrated that even deterministic systems may be unpredictable if they are of the chaotic type. Such systems are unpredictable in the long-term because they have the inherent property of amplifying any initial measurement error and because a real observer cannot make

any measurement without producing an error, no matter how small (Strogatz 1994: 324). So, a real system can be long-term unpredictable for a real observer without any necessity for randomness.

Our main point of disagreement with the Peircean cosmogony is exactly about the role he attributes to “pure chance” (or a ‘primeval chaos’ or ‘chance-medley’ (Toscano 2006: 125)) as a source of unpredictability. Instead, we propose Simondon’s conception of ontogenesis that starts with a metastable preindividual field consisting of “pure potentiality”. During the ongoing process of individuation, this pure potentiality becomes actualized – without, however, being completely exhausted, such that there is always room for further individuation. Alberto Toscano provides an illuminating comparison of the two approaches: “Peirce’s philosophy of habit ultimately presupposes the essentially undifferentiated character of the preindividual, whether as pure multiplicity or homogeneity, together with a seemingly inevitable, and ultimately teleological, progression to differentiated order. The introduction of metastability and disparation as traits of the preindividual allows Simondon to confront the persistence of heterogeneity, and to think of individuation as a real resolution – *the invention of a relation* – rather than as the ineluctable work of a repetition that is mitigated only by absolute chance or spiritual spontaneity.” (Toscano 2006: 151)

So, we part company with Jesper Hoffmeyer at the point where he adopts Peirce’s *Tychism*. We think that the apparent unpredictability of real phenomena *not necessarily* supports the conception of chance fluctuations as ontologically real. Simondon’s preindividual reality – without requiring more commitment than chance fluctuations – seems to be at least an equally eligible candidate for the same role. Furthermore, while Simondon and Peirce exhibit great similarities, particularly in their approaches to questions of crucial importance to biosemiotics, Simondon’s theory is supported with references to quantum mechanics, cybernetics, information theory, general systems theory etc., which Peirce could not have known about.

In conclusion, we suggest that adopting Simondon’s ontogenetic theory of individuation as a metaphysical account for making of history would be a fruitful step on behalf of both the philosophy of science and biosemiotics.

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Uniting is indeed the guiding principle behind this life that lies between birth and death: consciousness' brief illumination of its body-brain. Only in our consciousness do we appear to ourselves as one, or as 'someone'.¹

As a psychoanalyst I spend a great deal of time exploring and analyzing the very human problems surrounding identity, separation/individuation, and, predominantly, the difficulties and obstructions to making what is unconscious, conscious. Yet recalling that blissful state of undifferentiated merger that was ours in childhood – and that can be ours again, fleetingly, in the arts, in nature, listening to music, in deep concentration, or during orgasm – I sometimes question the benefits of this touted ‘consciousness,’ and wonder if it isn’t over rated! I sit in a tiny office, part of my New York Institute, which I call my analytic “cell” and ponder what advantages there are in being so “separate” and conscious. It has been my experience, in fact, that it is when body and mind, and I and ‘thou,’ are most united, that we experience those moments of greatest transcendence and deepest joy in this life. We do not leave the Garden of Eden, and walk out into ‘consciousness’, without incurring a significant loss!

But then, as I listen to dreams and free- associations spilling into the tiny room in “evenly hovering” attention mode, I begin hearing meanings seeping through the haze of words – much deeper poetic and fantastic meanings, murmuring from a substratum of human

¹ Hoffmeyer, Jesper 1996. *Signs of Meaning in the Universe*. Bloomington: Indiana University Press, p. 124.

experience where words have not yet shone a light, and where undifferentiatedness is the norm rather than the exception. Here, siblings and sensations turn into insects and creepy creatures; emotions are tsunamis or typhoons; moods manifest in dark or sunny days; complex ideas and abstractions form coded equations or geometric patterns; interpersonal dynamics reveal their starkest truths; and loneliness or ecstasy, alike, take us to the stratosphere.

Signs, symbols, and signification dominate the semiosphere of our *Innenwelt*. So when I read my first biosemiotic text, *Signs of Meaning in the Universe* – audacious title that it is! – I suddenly found my little analytic cell expanding! Biosemiotics, the new unifying discipline to which I had just been introduced, beckoned – its hierarchic premises and continuous principles synchronous with models of mind and ideas that I had already been toying with for a number of years. The tiny semiosphere I work in, and the semantic field of which it is a part, stretched and met Jesper Hoffmeyer's universe of meaningful signs!

It is significant, in this context, to draw attention to Freud's overarching conceptual dualism in vital processes that are embodied in the extreme polarization of love and hate, or creation and destruction, in the two principles of the Life and Death instincts: *Eros* – binding and joining together in ever new unities – versus *Thanatos*, dividing and tearing things apart. Unity and separateness are indeed at the foundations of consciousness, since in order to see, communicate, remember, or know anything we are obliged to single it out, identify it, and give it a name: that is, to 'signify' it. Yet without joining in empathically to share and understand another's deeper silent experience, we can never really hear or grasp the full breadth of unconscious signs being transmitted to us, or their meanings. The secret, then is to enter in and to step out, to unite and separate discriminately, and at will, consciously, from the center of that brief illumination where "I", just as Hoffmeyer suggests, has made us appear as 'someone' to ourselves.

PROOF

VIS A PROSPECTO

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*Biology is immature biosemiotics.*¹

Jesper Hoffmeyer's work challenges the exclusive reliance of modern biology on the idea of *vis a tergo* (mechanistic causalities of the past determining the future through the present), by demonstrating how the action of signs ('semiosis') introduces into behavior of organisms rather a *vis a prospecto* by which the future changes the relevance of past determinations to the present in opening the way to outcomes that cannot be simply predicted on the basis of mechanistic causality ('brute interactions of Secondness', as Peirce might put it). Emmeche, Kull, and Stjernfelt 'said it all' in the title of their 2002 monograph: to read Hoffmeyer is to rethink biology.

Hoffmeyer introduces in particular two 'new notions' required for full understanding of biological evolution: *semiotic scaffolding* and *semiotic freedom*. Key to both notions is the fundamental idea entitling one of his later essays (Hoffmeyer 2010a): '*Relations: the true substrate for evolution*'. The fact that in principle "a relation could be drawn between any two physical objects in the world", while "in all but very few cases" such relations "turn out to be absolutely uninteresting", Hoffmeyer observes (*ibid.*: 90), has led to the situation in modern science where "a strangely obvious thing" has come to be "generally dismissed by science as not really 'real'".

¹ Hoffmeyer, Jesper 2008. 'Biology is immature biosemiotics', *Semiotics 2008*, ed. J. Deely and L. Sbrocchi (= Proceedings of 16-19 October 33rd annual meeting of the Semiotic Society of America in Houston, TX). Ottawa: Legas, 2009, 927-942.

Hoffmeyer notes the difference between relations among things independent of awareness and these same relations once involved in awareness as enabling deception and some manipulation of surroundings. In this way, he demonstrates, the reality of relations among living creatures introduces a *vis a prospecto* (a 'future anticipation') into interactions, contrasting with exclusive use of *vis a tergo* relied upon by hardcore traditionalist evolutionary biologists (such as Dennett, Dawkins, *et alia*) to cling to the Cartesian denial of any 'final causality' in nature. Hoffmeyer shows how the reality of relations (within animal awareness in particular) makes possible an increasing *freedom* in living activity (*vis a prospecto*) as we ascend the evolutionary scale. In turn, this increasing freedom brings about new conditions and states which become the *scaffolding* upon which biological evolution depends in and for development of increasingly complex forms.

For relation has a *singular* being as the *only* form of finite being having status as awareness-independent or awareness-dependent determinable by circumstances alone: nothing of the being proper to relation as suprasubjective determines relation itself to be on one or the other side of that line. Only circumstances under which relation here and now exists or there and then existed do that. Precisely this indifference to awareness- (or 'mind-') independence in its proper reality is the feature of relation (its 'singularity') making semiosis in nature possible in the first place.

Hoffmeyer deftly points out that semiosis is the only form of causality involving nonbeing as well as being, *precisely by reason of* relation's singularity. (When Peirce observes [1907: CP 8.332] that "Thirdness is the triadic relation [...] considered as constituting the mode of being of a sign", he at the same time recognizes [with Hoffmeyer] that relations even when awareness-independent are not free-floating entities independent of subjectivities but require a foundation or basis in a subjectivity that belongs itself to the awareness-independent dimension of physical reality. This foundational dependence of suprasubjectivity [relation] upon subjectivity [Secondness, brute interaction], then, gives nature ability to prove-nate relations – awareness-independent or awareness dependent depending upon circumstances at the time.)

In this way relation's singularity enables even lifeless being to fall under the *vis a prospecto* that becomes fully actual with the

achievement of life. To quote Hoffmeyer (2008a: 938): “contrary to physically based interactions [between subjectivities], semiotic interactions [as involving suprasubjectivity] do not depend on any direct causal connection between the sign vehicle and the effect. Instead, the two events are connected through the intervention of an interpretive response” – which, as originally noted by Peirce, “need not be mental”.

In sum, the “complicated capacity for anticipation” Hoffmeyer outlines (2008b: 35; 2010a: 93) as required for ‘more sophisticated systems’ to emerge and survive is rooted in relation’s singularity as opening nature to Thirdness – not only at the level of life (cf. Hoffmeyer 2010b), but even at the physical level of pre-life when and wherever the universe definitively exhibits the openness of movement toward a future (*vis a prospecto*) where life will become actual within the cosmic whole. As Hoffmeyer put it in 1998: “Rather than an either-or category semiosis is a more-or-less phenomenon ... implicit in the whole idea of evolution as a process of increasing semiotic freedom.”

I would note, finally, what sets Hoffmeyer’s work apart from many of his semiotic colleagues in 2012: he really understands that biosemiotics cannot afford to repeat in reading of nature the error that Saussure and his epigones made in reading of culture, namely, reduction of sign-action (semiosis) to translation of ‘codes’. *Biosemiology* is as much part only of *biosemiotics* as is semiology of semiotics; a Barbierian equation of the former two is as much a ‘pars pro toto’ fallacy as was the original equation of the latter two among Saussureans. Sebeok first identified the fallacy; Hoffmeyer after Sebeok fully avoids it by understanding the role in nature of relation’s singularity.

It is not too much to say that Jesper Hoffmeyer is to biosemiotics what Albert Einstein was to relativity theory, to wit, the single figure at the forefront of the theoretical coalescence of a scientific development which was inevitable as ‘in the air’ (that is, inevitable as a development whose ‘time had come’, and so would coalesce around *someone* or other), yet required someone *in particular* to articulate the vision and lay out the arguments making the ‘inevitable development’ an actual historical phenomenon.

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PROOF

**PUBLICATIONS
BY JESPER HOFFMEYER
IN ENGLISH**

Compiled by Kalevi Kull

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Below is a chronological list of published English-language texts by Jesper Hoffmeyer.¹ I have tried to make this list as complete as possible; however, some there may still be some publications that are unaccounted for here.² An earlier list of his publications from 1968 to 2002, in all languages, has been published in *Tartu Semiotics Library* 3, 2002.³ A list detailing all of Jesper Hoffmeyer's works in Danish (which are particularly numerous), as well as his works translations into many other languages for last ten years, has yet to be compiled.⁴

1968

Hoffmeyer, Jesper 1968. Inhibition of growth of *Salmonella typhimurium* by adenosine. *Fifth FEBS Meeting* (July 1968, Prague). *Abstract no 493*. Prague.

1971

Hoffmeyer, Jesper; Neuhard, Jan 1971. Metabolism of exogenous purine bases and nucleosides by *Salmonella typhimurium*. *Journal of Bacteriology* 106(1): 14–24.

¹ His full name is Jesper Normann Hoffmeyer. However, he almost never used the middle name.

² Particularly, publications appearing in conference abstract books and other smaller publications.

³ Emmeche, Claus; Kull, Kalevi; Stjernfelt, Frederik 2002. *Reading Hoffmeyer, Rethinking Biology*. [Tartu Semiotics Library 3.] Tartu: Tartu University Press, 61–71.

⁴ In the current list, the alphabetic enumeration of entries within a particular year corresponds to the markings in Emmeche *et al.* 2002.

1977

Hoffmeyer, Jesper 1977. Energy and the need for a new socio-political homeostasis. In: Thill, Georges (ed.), *Un lieu de contrôle démocratique des sciences: le débat nucléaire. A Case of Democratic Control of Sciences: The Nuclear Issue*. (Actes du Colloque interdisciplinaire et international. Proceedings of the Conference.) Namur: Faculté universitaire de Namur, Département de philosophie de l'homme de sciences, 296–345.

1987

Hoffmeyer, Jesper 1987. The constraints of nature on free will. In: Mortensen, Viggo; Sorensen, Robert C. (eds.), *Free Will and Determinism: Papers from an Interdisciplinary Research Conference*. Århus: Århus University Press, 188–200.

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Hoffmeyer, Jesper 1988a. Bioinformation techniques and the view of nature. In: Thill, Georges; Kemp, Peter (eds.), *Le Triomphe des biotechnologies: la domestication de l'animal humain – The Triumph of Biotechnologies: The Domestication of the Human Animal*. (Actes du Cours de l'Inter-University Centre de Dubrovnik, mars 1986.) Namur: Presses universitaires de Namur, 83–92.

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1993

Hoffmeyer, Jesper 1993a. Asian perceptions of nature. *Tidsskrift Antropologi* 27: 183–184.

Hoffmeyer, Jesper 1993b. Biosemiotics and ethics. In: Witoszek, Nina; Gulbrandsen, Elizabeth (eds.), *Culture and Environment: Interdisciplinary Approaches*. (Nature and Humanities Series vol 1.) Oslo: Centre for Development and the Environment, University of Oslo, 152–175.

1995

Hoffmeyer, Jesper 1995a. The swarming cyberspace of the body. *Cybernetics and Human Knowing* 3(1): 16–25.

Hoffmeyer, Jesper 1995b. Biosemiotics and ethics. In: Shiva, Vandana; Moser, Ingunn (eds.), *Biopolitics. A Feminist and Ecological Reader on Biotechnology*. London: Zed Books, 141–161.

Hoffmeyer, Jesper 1995c. The semiotic body-mind. In: Tasca, Norma (ed.), *Essays in Honor of Thomas A. Sebeok*. (*Cruzeiro Semiótico* 22/25). Porto, 367–383.

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Hoffmeyer, Jesper 1997a. The global semiosphere. In: Rauch, Irmengard; Carr, Gerald F. (eds.), *Semiotics Around the World: Synthesis in Diversity. Proceedings of the Fifth Congress of the International Association for Semiotic Studies. Berkeley 1994*. Berlin: Mouton de Gruyter, 933–936.

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